

Hospital Outpatient Space Utilization

By

Jim Hoeting & Matthew Sherman

Submitted to
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in Partial Fulfillment of the Requirements for
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Abstract

The Hospital Outpatient Space Utilization project was conducted on behalf of Cincinnati Children's Hospital Medical Center (CCHMC) according to their written specifications. It resulted in a software tool that reports on the occupancy rate of the hospital's outpatient exam rooms. As part of their ongoing effort to drive out cost and streamline their operations, CCHMC desired a web-accessible application that can answer the question "Is our clinic exam room capacity being utilized efficiently for outpatient services?" Analysis and presentation of information that answers this question is made available by our web application across all CCHMC divisions and clinic locations in Greater Cincinnati.

Clinic space utilization for outpatient services is a function of the length of patient visits, how many exam rooms exist within clinics and to what divisions they are assigned, and when clinics are open for business. Features in our application include calculation and aggregation of simulated data extracted from their medical records system (EPIC), persistent storage of this data, the ability to change key variables that affect calculations, and reports that display information for the primary information consumers, hospital Business Directors.

Valid users can access our application via a browser. Once authenticated, users can display the outpatient exam room space utilization for all outpatient facilities aggregated by division, clinic, and the day of the week.

1. Project Description and Intended Use

The Hospital Outpatient Space Utilization project was conducted on behalf of Cincinnati Children's Hospital Medical Center (CCHMC) according to their written specifications. It resulted in a software tool that reports on the percent utilization of outpatient exam rooms. According to CCHMC's project documentation, our software application had to answer the question "Is our clinic exam room capacity being utilized efficiently" (17)? Analysis and presentation of information that answers this question is made available by our web application across all CCHMC divisions and clinic locations in Greater Cincinnati.

"Clinic space utilization is a function of how long visits take with patients, how many rooms are assigned to a clinic, and when a clinic is scheduled" (17). Therefore, features in our application include calculation and aggregation of data that simulates data extracted from their medical records system (EPIC), persistent storage of this data, the ability to change key variables that affect calculations, and reports for the primary information consumers, hospital Business Directors.

Any valid user can access this application via a browser. Once authenticated, the web application allows interaction with the user, including the ability to enter, edit and extract information regarding outpatient exam room usage. Users can display outpatient exam room space utilization data aggregated by division, clinic location and the day of the week by drilling down into those areas for greater specificity.

Note that once authenticated, the user is presented only with the information that they are allowed to view. It is important that the user is only presented with information

that is pertinent to their division, and that all data gathered from patient records be anonymized.

1.1 Problem Statement

1.1.1 Overview

Hospitals, similar to other businesses and organizations, continually need to evaluate their operations and expenditures in order to stay viable. The problem area that we are addressing with our project is related to hospital operations for outpatient services.

As a result of continuing research and improved medical procedures, more outpatient services can be offered by hospitals. As the ability to offer these services over inpatient care has expanded, there appears to be an overall long term trend toward outpatient services. Provided that the quality of care isn't affected, it makes sense to trend toward outpatient services. "Cost efficiency has been increased by the shift to outpatient surgery (4)." In fact, this has been recognized by Congress when "policy change was intended to encourage the shift of surgical procedures from inpatient to less costly ambulatory [outpatient] settings" (16).

From a practical standpoint, hospitals and medical centers offering healthcare, need to understand and manage the infrastructure and cost required to provide these outpatient services. As such, healthcare providers analyze the space requirements of providing such services. In order to drive out cost, it is important to understand what fixed space resources a provider has and how this interrelates to services provided. "It's very hard to get cost out of facilities. It costs about the same to use 50 percent or 80

percent of a space, so it's important to look at operational opportunities to maximize facility use (11).”

Research suggests that hospitals across the country are dealing with the same reality. At Lee Memorial Hospital in Fort Myers, Florida, for example, Dave Kistel, Vice President of Facilities, stated "we're trying to make sure that we utilize our space wisely, create great work environments for staff, and efficiencies in operations" (15). “After determining baseline measures of current capacity and utilization, hospitals can apply benchmarks for market demand, financial impact, labor productivity, facility and workload capacity, and space allocation, efficiency and effectiveness (15).” Another example is the Kettering Medical Center in Dayton, Ohio which “for years has been struggling to find a way to accommodate steadily increasing inpatient and outpatient volume and rapidly evolving technology within its landlocked footprint” (15).

It is apparent that understanding, analyzing and managing outpatient space utilization presents a significant problem in the healthcare industry. This is the focus of our local project at CCHMC. Work is underway at CCHMC to understand and optimize clinical capacity management. Specifically, they “need to measure current space utilization in order to identify where opportunities for improvement exist” (1).

The impact of this work is real and substantial. According to CCHMC, there were a total of 825,804 outpatient visits in 2009 (5). So the impact of improving availability and cost improvements through space optimization could affect thousands of patients' access to health care in the future.

Our project is an operational efficiency improvement project that enables management to make well informed decisions regarding outpatient usage of hospital

resources. “Given the current health care reform focus on cost, optimal utilization of fixed resources such as staff and space to optimize patient care and safety while reducing costs, has already provided a robust business model for ROI (6).”

CCHMC Outpatient Clinical Systems Improvement’s goal is to measure exam room space consumption this year, and optimize that space the following year. Their purpose is to increase efficiency and productivity (2).

At our project’s inception, they had no application in place to aid in achieving this goal. They looked into other solutions, including open source options, but had only a spreadsheet application to track related data. Spreadsheet files can be an inaccurate or unreliable way to track information because of their potential mobility and duplication. While commercial and open source healthcare software exists, it appears it is too broad in scope. In other words, it is overkill for our specific detailed requirements.

1.1.2 Specifics

Unlike other hospital services, such as emergency, outpatient services at hospitals are generally services rendered at the hospital via an appointment, similar to a doctor’s office. CCHMC has many exams rooms available for this purpose. These rooms are used by approximately 30 different hospital divisions at approximately 14 locations in Greater Cincinnati (8). Examples of hospital divisions are Cardiology, Neurology and Dermatology.

For most cases, patient flow through these rooms starts as patients arrive for either a 30 or 60 minute appointment. A Registration Clerk checks the patients in, and a nurse calls them to get vital signs. Inside the exam room, treatment is provided to the patients

by a caregiver. Upon completion of treatment, the patient checks out and a cycle time or length of stay (LOS) can be calculated. Cycle time is measured from the time a patient is called to vital signs to the time they check out.

Cycle time of patient flow through exam rooms is of interest to CCHMC because it is a metric that suggests the efficiency of care delivery, and is also a component of calculating exam room space requirements. The number and length of cycle times need to be collected and analyzed. Given their existing space constraints, analysis of this data will determine how many patients can be seen and whether more space should be requested. The need to securely store, analyze and present this outpatient data is the basis of our IT project.

One of the benefits realized by such a solution that can store, analyze and present outpatient data is the ability of hospital management to improve the amount and quality of care through an enhanced understanding of outpatient service metrics. Consider the example of an underutilized exam room (<65% occupancy), and that of an over utilized exam room (>85% occupancy) (1). In the case of an underutilized exam room, suppose a certain type of treatment can only be given in particular rooms, and only two of those rooms exist. If those two rooms were identified as being underutilized, more patients could be scheduled to receive services in those rooms. Next, suppose treatments given in an over utilized exam room were often interrupted, delayed or cancelled because of room scheduling conflicts. These patients may get shuffled around, spend extra time in the waiting area, or even have to reschedule their appointment. By avoiding overcrowded rooms through enhanced planning, patients would no doubt feel they have received better service and overall care.

A more tangible benefit realized by a solution that can store, analyze and present outpatient data is the ability of hospital management to optimize existing and future space. Hosting exam rooms requires overhead in terms of utility expenses and labor costs. Exam rooms require maintenance. By ensuring that room use is optimal, cost is driven out while maintaining quality of care. An obvious example is a scenario where each of two rooms is occupied for only a few hours a day. If patients could be rerouted to use only one exam room in this case, the cost of maintaining the other could be mitigated.

Given CCHMC's goal of achieving optimal utilization of fixed resources, our solution, by making data available that was unavailable, enables the hospital to maximize care while driving out unnecessary time and cost associated with patient flow through outpatient exam rooms.

1.2 Stakeholders

The primary stakeholders of our project are CCHMC Outpatient Clinical Systems Improvement and Jana Bazzoli, Vice President of Clinical Affairs. The 'Outpatient Space Utilization Tool' project is headed by Outpatient Clinical Systems Improvement and Jana Bazzoli is the Project Lead. She works closely with directors to improve clinical care and systems (9). Dr. Keith Marsolo, Director of Software Development and Data Warehouse, is the secondary stakeholder. His development team, with whom we worked, is responsible for the delivery of the solution. Finally, the overall organization and patients that receive services from CCHMC are indirect stakeholders in this project as they will be affected by its success.

1.3 Description of the Solution

The data points collected include the number of new and returning patients, the amount of time they are in treatment (cycle time), the exams rooms used, and the hours of operation of those exam rooms. From these data points, the solution application performs appropriate calculations of exam room utilization (in percentage), and makes that information available for decision makers.

Security is also an important concern. Therefore, the solution implements role based authentication. It segments the information presented, based on the role of the user.

Figure 1 below illustrates output data from the requirement specifications. CCHMC has provided us with this sample, which shows only sample data, not real patient data (1). As mentioned earlier, they are using a spreadsheet application to track related data; this is an example of the information that they want to collect. Note that “Ambulatory” simply refers to “walk-in”, or outpatient. It does not refer to services provided by an ambulance.

Exam Room Space Components		Key Input Data										Calculations		
		New Patients		Return Patients		Hrs of Operation		Exist. Exam Rm		Exist. Util.		Desired Util.	Est # of AM Rms	Est # of PM Rms
		Number	LOS(Min)	Number	LOS (Min)	AM	PM	AM	PM	AM	PM			
Adolescent Medicine		14	60	11	30	4.0	4.0	7	7	35%	35%	70%	4	4
	Mon	14	60	11	30	4.0	4.0	7	7	35%	35%	70%	4	4
	Tue	10	60	5	30	4.0	4.0	7	7	22%	22%	70%	3	3
	Wed	14	60	5	30	4.0	4.0	7	7	29%	29%	70%	3	3
	Thur	10	60	8	30	4.0	4.0	7	7	25%	25%	70%	3	3
	Fri	0	60	8	30	3.0		7		19%		70%	2	
Allergy		14	60	11	30	4.0	4.0	7	7	35%	35%	70%	4	4
	Mon	14	60	11	30	4.0	4.0	7	7	35%	35%	70%	4	4
	Tue	10	60	5	30	4.0	4.0	7	7	22%	22%	70%	3	3
	Wed	14	60	5	30	4.0	4.0	7	7	29%	29%	70%	3	3
	Thur	10	60	8	30	4.0	4.0	7	7	25%	25%	70%	3	3
	Fri	0	60	8	30	3.0		7		19%		70%	2	
BMCP		5	60	4	60	4.0	4.0	4	4	28%	28%	70%	2	2
Cardiology		20	60	10	60	4.0	4.0	4	4	94%	94%	70%	6	6
DDBP		4	60	10	30	4.0	4.0	4	4	28%	28%	70%	2	2
Dermatology		20	60	11	30	4.0	4.0	4	4	80%	80%	70%	5	5
Endocrinology		20	60	11	30	4.0	4.0	4	4	80%	80%	70%	5	5
Gastroenterology		12	60	15	30	4.0	4.0	4	4	61%	61%	70%	4	4
Hematology/Oncology		20	60	11	30	4.0	4.0	4	4	80%	80%	70%	5	5
Human Genetics		20	60	11	30	4.0	4.0	4	4	80%	80%	70%	5	5
Infectious Diseases		20	60	11	30	4.0	4.0	4	4	80%	80%	70%	5	5
Nephrology		14	60	11	30	4.0	4.0	4	4	61%	61%	70%	4	4
Neurology		14	60	5	30	4.0	4.0	4	4	52%	52%	70%	3	3
PM&R		14	60	5	30	4.0	4.0	4	4	52%	52%	70%	3	3
Psychiatry		14	60	5	30	4.0	4.0	7	7	29%	29%	70%	3	3
Pulmonology		14	60	5	30	4.0	4.0	7	7	29%	29%	70%	3	3
Rheumatology		6	60	8	30	4.0	4.0	4	4	31%	31%	70%	2	2
Sports Medicine		3	120	4	60	4.0	4.0	3	3	42%	42%	70%	2	2
Overall Dept. of Peds		344		233				153	139				97	93

Key Assumptions	
1. Space estimates based on highest use day of week.	<65% Underutilization of Current Space
2. Length of stay indicates time in treatment area only.	65% Overutilization of Current Space
3. Room calculations rounded to near whole room number.	65%-85% Optimal Space Utilization

Figure 1. Sample output from CCHMC project requirements (1)

Although the exact number of people who will use the solution is unknown, there will be at least 30. There are 30 divisions and they are geographically dispersed across the city. As mentioned earlier, the primary target users are Business Directors. At some point, it is likely that their staff and other hospital administrators will want or need access. So the system is scalable to accommodate potentially hundreds of users over time. A simple client based solution would likely be problematic in terms of deployment (e.g. installation time, incompatible hardware or operating system). The most logical choice was to implement our solution as a web based application. Because the application is intended to reside in one secured, well maintained location, and accessed via a web browser, many potential compatibility and availability issues are avoided.

Furthermore, the amount of time that support administrators spend maintaining the system is reduced using a web application verses a client based application.

1.4 User Profile

The primary users of the application are Business Directors. Their staff of administrators and other hospital management personnel are also likely candidate users. These users are well acclimated to the use of windows and web-based interfaces. Each is familiar with accessing applications, entering and editing data in forms, and viewing reports. Little training should be required. At first there will be at least 30 users, but this will likely grow to 100+.

The aforementioned users will generally use the solution application on a cyclic basis, quarterly or annually. Similarly, the reports generated from the solution application will most likely be accessed on a period basis. This does leave time between uses. However, the simplicity of the interface should not present a problem when the users attempt to use the system after a time lapse.

2. Design Protocols

The constraints and design considerations of our solution include design elements in five main areas: System Interaction, Data Storage, Organizational Scheme, Interface and Technologies.

2.1 System Interaction

Implementation of our solution at CCHMC requires direct or indirect interactions with other systems as well as users. The data to be analyzed will be provided by both extracts from their medical records system (EPIC) and data entered by System Administrators. Our design simulates both methods. However, because direct EPIC formatted output has not been authorized, format assumptions were used for our bulk data import tool.

Authentication of application users has also been simulated to account for existing hospital servers that perform those services (Active Directory for example).

The application requires hosting on an internal Internet Information Services (IIS) web server on CCHMC's network.

Similarly, the application database would be hosted by an internal secure application server at CCHMC. Currently our database is being hosted by a third party at winhost.com.

The Use Case Diagram in Figure 2 shows a system-level view of our solution application. The tasks that are accomplished by the application on behalf of the actors are enclosed in circles within the black boundary.

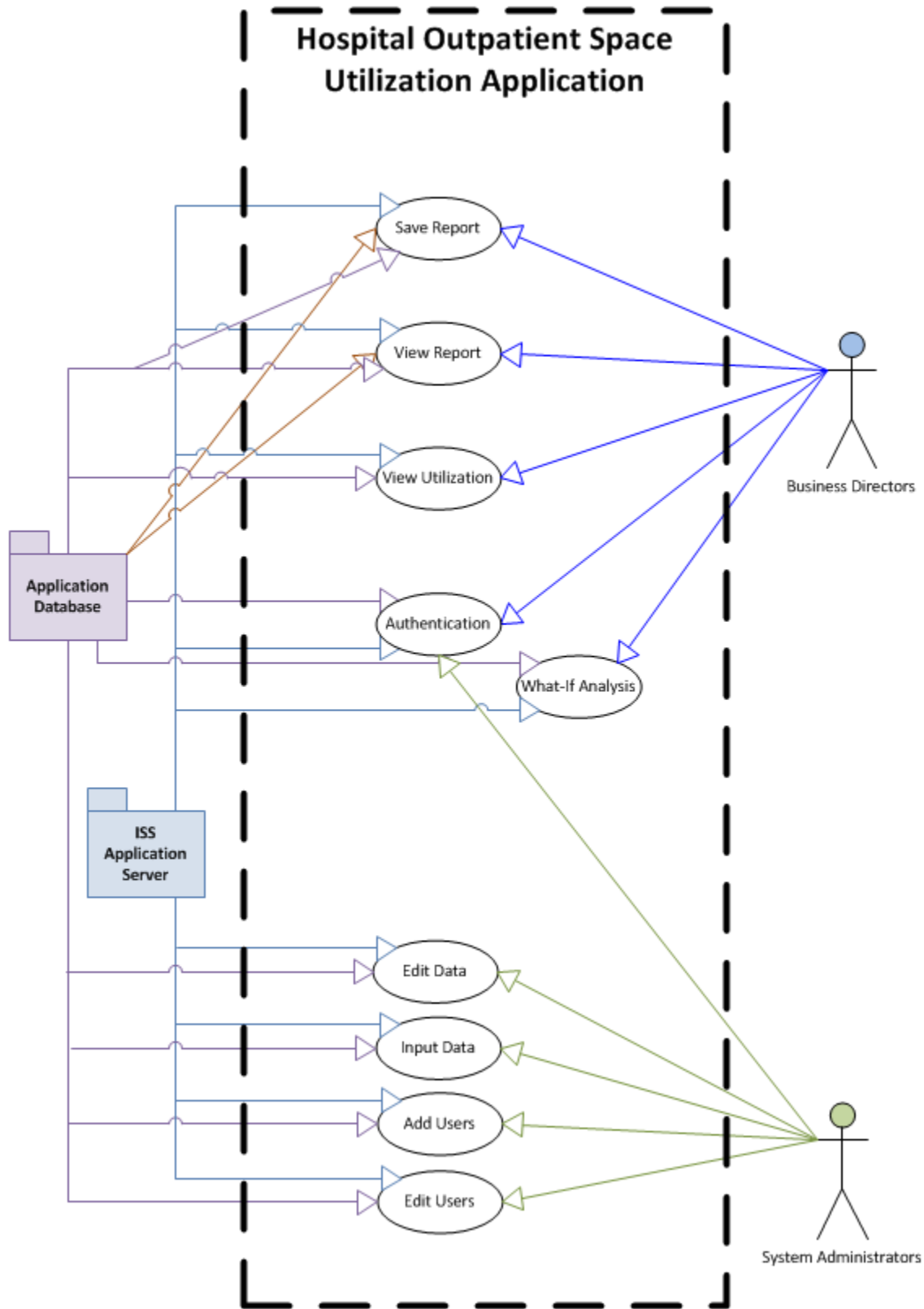


Figure 2. Use case diagram: Overview of system interaction

Note that there are a total of four actors, two human actors (equivalent to roles) and two system actors (hardware and services). The human actors are denoted by sticks while the system actors are denoted with box geometry, distinguishing the two types.

2.2 Data Storage

Physical implementation of the database to store all of the application data was constrained to SQL Server 2008, as that is what CCHMC has licensed. However, the design was left up to us. We implemented a relational database. Four tables are used to store user and role data. Two tables are used exclusively to store historical data (prefixed with “Audit”). The remaining tables store both the current and historical data needed for the output. One-to-One, One-to-Many, and Many-to-Many relationships are used, with join tables resolving the Many-to-Many relationships. See Figure 3 for a complete diagram.

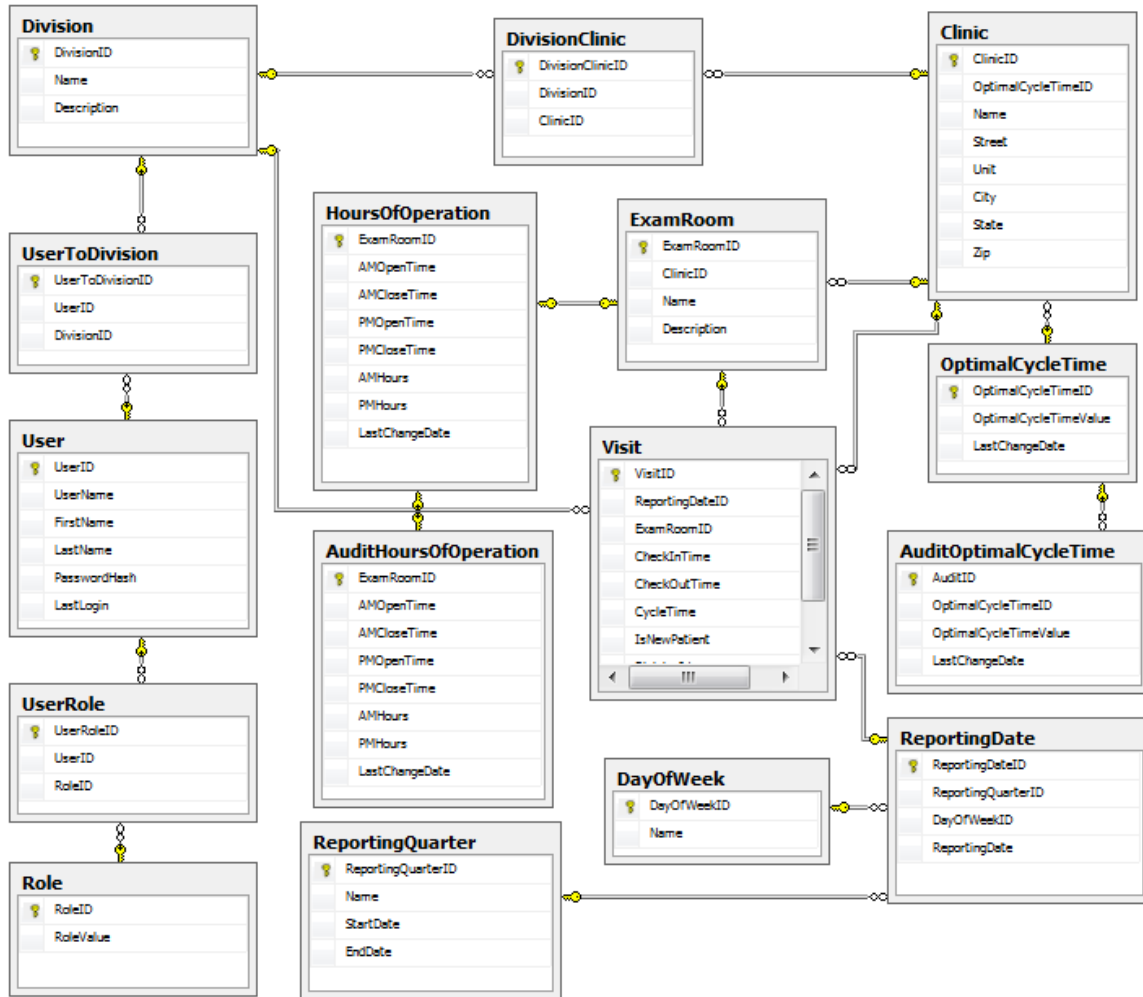


Figure 3: RDBMS database diagram

As previously noted, currently our database is being hosted by a third party at winhost.com. Screenshots of the connection are included in the Proof of Design section.

2.3 Organizational Scheme

The workflow of the application and available tools are organized by user permissions. Each role, System Administrator and Business Director, should have

different capabilities. So, depending on the login credentials, the user is directed to one of two landing pages. Figures 4 and 5 show the headers of the two landing pages.

User Name:
Password:



Figure 4. Result of logging in with role as System Administrator

User Name:
Password:

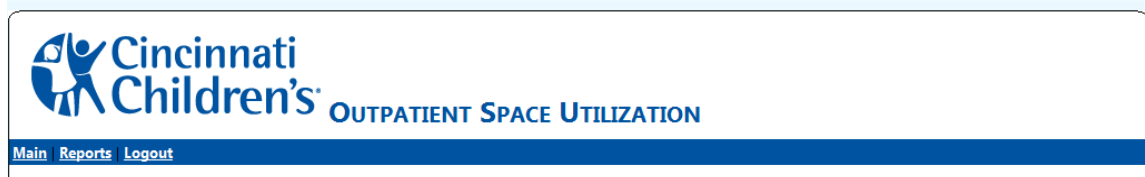


Figure 5. Result of logging in with role as Business Director

All the tools needed for each type of user are made available on these landing pages. For example, a user with the role of System Administrator can access any of the tools used to modify the data in the database. Users with the role of Business Director can select and change input data used to generate utilization output.

2.4 Interface

The interface design elements in our application include navigation, graphics and color scheme. A theme of our interface is that it should be simple and serious in nature. This is contrasted against applications that are intended for entertainment or advertising, for example. Lastly, these considerations are for internal CCHMC users as opposed to the external public.

2.4.1 Navigation

Once logged in, users will use only text hyperlinks to access the various tools available to them. This is accomplished using ASP.NET Master Pages. They serve as page templates and enable access to tools seemingly without switching pages. The advantage of this approach is that each tool is only one click away. Contrast this with applications that require accessing menu items three levels deep in order to access desired functionality.

2.4.2 Graphics

The use of graphics is limited because there is little need for them. The addition of more graphics could clutter up the interface. More importantly, additional graphics may be considered overdesign for the specified project requirements. The exception is the logo graphic used on all master pages. It denotes ownership and branding. It is used to assimilate our application with other interfaces used by the hospital.

2.4.3 Color Scheme

The colors used in our application are similar to CCHMC's existing external website. That site uses blue, white and gray extensively, especially in navigation. Blue, white, gray and black are the only colors used in our application. Again, this is consistent with our theme that is intended to convey a sense of seriousness and simplicity.



Figure 6. Children's Hospital's external website

2.5 Technologies

Incorporated in this section are the programming languages used as well as development and collaboration tools. The application uses the MS ASP.NET framework with C# as the code behind. It is written against the MS .NET 3.5 framework which CCHMC currently has deployed.

For code development we used MS Visual Studio 2010. MS Visio 2010 was used for database design while MS SQL Server 2008 Management Studio was used for database implementation.

In terms of collaboration tools, we used xp-dev.com and AnkhSVN for sub versioning source control, allowing the two of us to work on the project simultaneously while not overwriting each other's code. Finally, we used a service from winhost.com to host our database in order for the application to access the database without having to alter connection strings in the Web.config Visual Studio project file.

3. Deliverables

Our Deliverables follow the organizational scheme explained in our design protocols (2.3 Organizational Scheme). They are broken out by user role. Each of them is associated with System Administrators, Business Directors, or both.

For System Administrators and Business Directors:

- Create a new secure login with role and view permissions;
- Login to the web application;
- Access landing page showing web controls that are available based on role;
- Use navigation controls to access multiple secure web pages

For Administrators Only:

- Add/Edit hospital divisions that provide outpatient services;
- Add/Edit hospital clinics that provide outpatient services;
- Add/Edit which clinics perform which division's services;
- Add/Edit exam rooms at clinics;
- Add patient visits;
- Change current hours of operation for specific exam rooms;
- Change reporting quarter dates;
- Change optimal cycle times for clinics

For Business Directors Only:

- Ascertain which clinic locations perform services for a specific hospital division;
- Determine the space utilization of outpatient exam rooms at a specified clinic location over a specified period of time;
- Determine the space utilization of outpatient exam rooms for a specified division over a specified period of time;
- Determine the space utilization of outpatient exam rooms for a specified division and clinic over a specified period of time;
- Determine all of the above, distinguishing between new and returning patients

4. Project Planning

Our original timeline estimate from an earlier phase of the project was broken down into general areas that we felt needed to be addressed for completion of the solution application. Figure 7 shows these main areas.

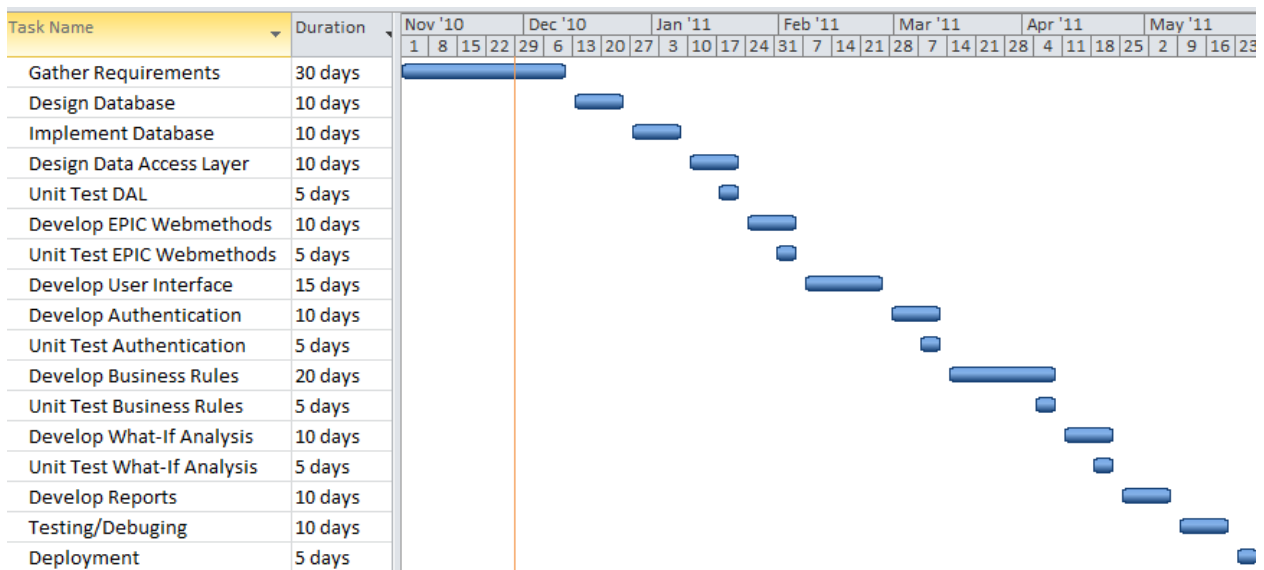


Figure 7. Original project timeline

The process of gaining authorization to attend project meetings at the hospital took much longer than originally anticipated. Getting badge approval - filling out

required paperwork, obtaining immunizations and drug tests, paying badge fees, etc. - took over two months, affecting our intended onsite interaction time with the development staff. This was a challenge. However, we still were able to use the original requirements to setup our development infrastructure, design and implement an RDBMS database, create LINQ-To-SQL classes that enable retrieval, editing and deletion of data in the database, create an authentication mechanism based on user roles, and create an interface with most of the core functionality for the System Administrator role.

4.1 Schedule

As we became more familiar with the project requirements, we adjusted our timeline tasks to include more well-defined deliverables. Figure 8 illustrates the rework of the schedule in early March with the more well-defined deliverables.

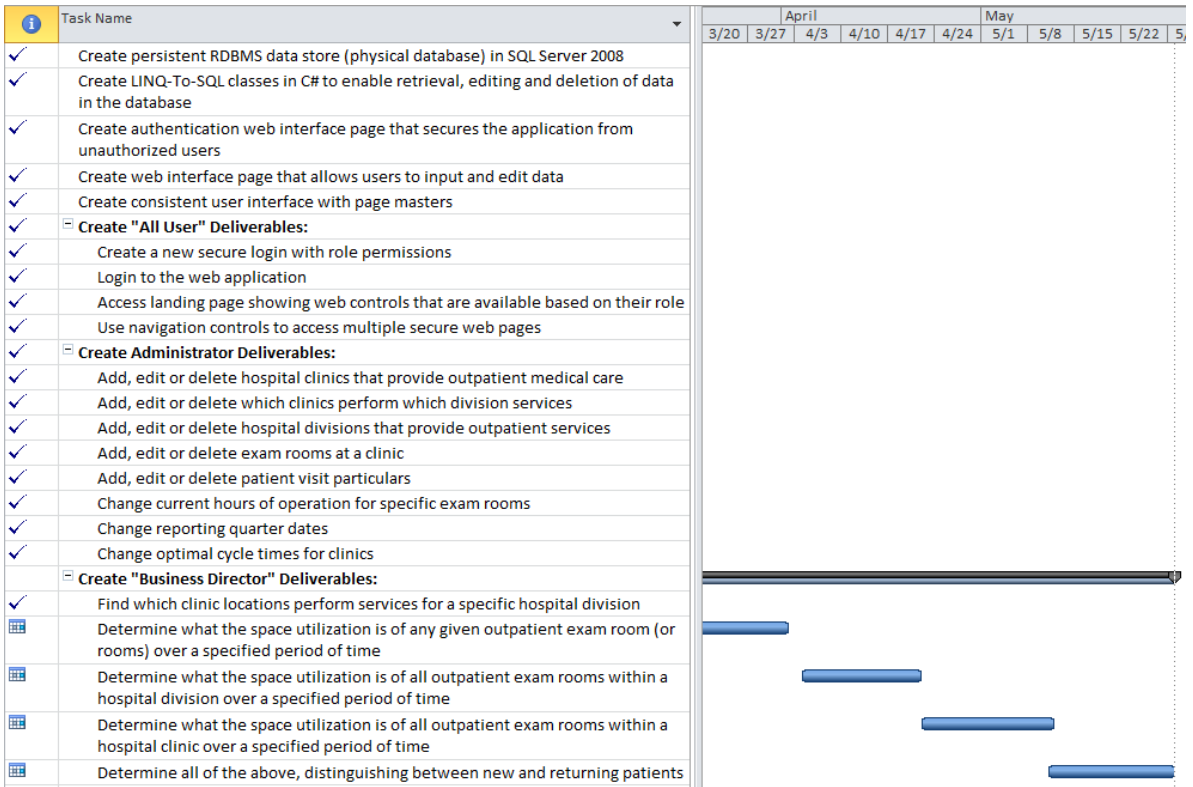


Figure 8. Timeline for completion of remaining project deliverables

It includes all functionality applicable to *both* System Administrators and Business Directors, functionality applicable to *only* System Administrators, and functionality applicable *only* to Business Directors.

The task list in Figure 9 was developed as a guide for completing the project. It includes tasks and dates in support of the well-defined deliverables.

Task Name
***** Spring Qtr. 2011 Weekly Tasks *****
<i>Tasks in green indicate a fixed due date.</i>
Week 1 (3/28/2011 - 4/3/2011)
Backup and organize project files from previous qtrs.
Due April 4th: Plan your spring quarter by dividing the remaining work into weekly tasks.
Meet w/ advisor on project status.
Team meeting to determine next steps.
Load Clinic & Division information into database from CCHMC website.

Due April 1st: Write and submit weekly report to advisor.
Prototype ideas for drill down
Comment all existing code and ensure all errors are handled.
Week 2 (4/4/2011 - 4/10/2011)
Create business logic to enable Business Director (BD) to determine space utilization of outpatient exam rooms over a specified period of time.
Start developing "drilldown" functionality in UI that allows BD to dynamically browse utilization results.
Start creating SQL Server Reporting Services (SSRS) reports in database.
Due April 8th: Write and submit weekly report to advisor.
Week 3 (4/11/2011 - 4/17/2011)
Continue developing UI "drilldown" functionality as defined above.
Continue development of SSRS reports in database.
Due April 18th: Submit an abstract for your project following the template for writing an abstract in the templates section.
Due April 15th: Write and submit weekly report to advisor.
Week 4 (4/18/2011 - 4/24/2011)
Meet w/ advisor on project status (Tues 4-19 @ 3:30 pm in A309).
Continue developing UI "drilldown" functionality as defined above.
Implement SSRS reporting functionality into UI so BD can access reports. *AGREED TO SWITCH TO REPORTVIEWER AT MEETING
Due April 22nd: Write and submit weekly report to advisor.
Week 5 (4/25/2011 - 5/1/2011)
Implement "drilldown" functionality in UI enabling BD to dynamically browse utilization results.
Test all reporting functionality, with test results and fix any bugs.
Create "Help" section in UI.
Due April 29th: Write and submit weekly report to advisor.
Week 6 (5/2/2011 - 5/8/2011)
Meet w/ advisor on project status (Tues 5-3 @ 3:30 pm in A309).
Test all code: User testing / Testing documentation.
Add styling to UI to make interface more attractive.
Deploy site to CD (or other media) for final report manual.
Due May 6th: Write and submit weekly report to advisor.
Week 7 (5/9/2011 - 5/15/2011)
Due May 16th: Submit a draft for your report. The draft will be evaluated and returned to you within a week.
Due May 13th: Write and submit weekly report to advisor.
Week 8 (5/16/2011 - 5/22/2011)
Meet w/ advisor on project status (Tues 5-17 @ 3:30 pm in A309).
Create Final Presentation.
Due May 20th: Write and submit weekly report to advisor.

Week 9 (5/23/2011 - 5/29/2011)
Present on 5/23/2011.
Implement changes on Final Report from Hazem's feedback.
Due May 27th: Write and submit weekly report to advisor.
Week 10 (5/30/2011 - 6/5/2011)
Meet w/ advisor on project status (Tues 5-31 @ 3:30 pm in A309).
Complete work on Final Report & professionally bind.
Due June 6th: Submit the final report following the guidance you received from the evaluation of the draft report and following the guidelines of the final report submission included in the Templates section.
Due June 3rd: Write and submit weekly report to advisor.

Figure 9. Weekly task list

4.2 Budget

The overall cost to reproduce our project remains largely unchanged from our original projection in the first phase of the project. The exceptions are the monthly hosting fees for hosting our database by a 3rd party and MS Visio used for designing the database. Table 1 below shows the estimated cost for the software, hardware and services needed to develop our solution.

<u>Software/Hardware:</u>	<u>Price:</u>	<u>CCHMC Cost:</u>
MS Visio Professional 2010 (18)	\$560	\$0
MS SQL Server 2008 R2 Enterprise (1 server license) (12)	\$8,592	\$0
MS Visual Studio 2010 Ultimate (13)	\$11,899	\$0
WinHost Basic \$4.95/MO (19)	\$90	\$0
XP-Dev.com (20)	\$0	\$0
AnkhSVN (21)	\$0	\$0
Web Server (Dell PowerEdge R310 Rack) (10)	\$649	\$0
Database Server (Dell PowerEdge 2970 Rack) (10)	\$799	\$0
TOTAL:	\$22,589	\$0

Table 1. Non-labor related development costs

Although CCHMC has the software and server space available, we listed the cost from Microsoft and estimated the cost of servers as if the solution was purchased separately. The numbers beside the product names are citing references.

5. Proof of Design

This section includes a number of screen shots and descriptions that show our application in action. These images should allow the reader to understand the workflow and tools available in the application. Effort has been made to illustrate the application performing tasks or scenarios, as opposed to simply showing screen captures of each button or menu item. Focus is shifted from functionality, to application usability and how that usability achieves our deliverables and project goals.

Prior to stepping through the running application, first examine the database connection. We are using SQL Server Authentication mode, as opposed to Windows or Mixed mode. Figure 10 shows the login screen when connecting to our database on the server.



Figure 10. Connecting to the application database

Figure 11 show the database in SQL Server Management Studio (SSMS) after the connection has been established. This is the database to which the web application will be connecting.

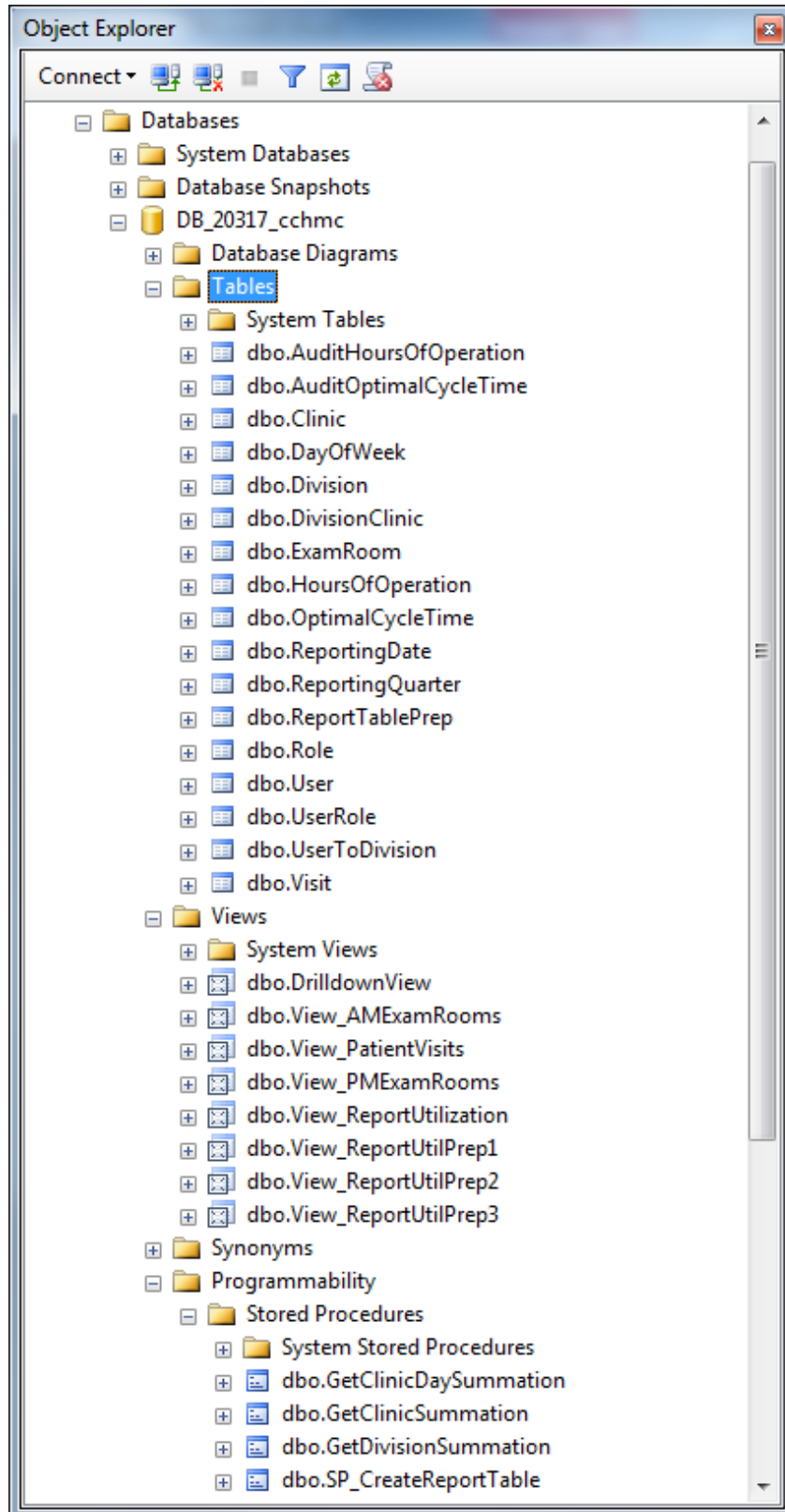


Figure 11. Object Explorer in SQL Server Management Studio (SSMS)

Upon launching the application, users are presented with the login screen (Figure 12). Users will be Business Directors or System Administrators. The screens and tools available to the primary users will be illustrated first, followed by those of the System Administrators. Figure 13 shows the landing page for the primary users, Business Directors.

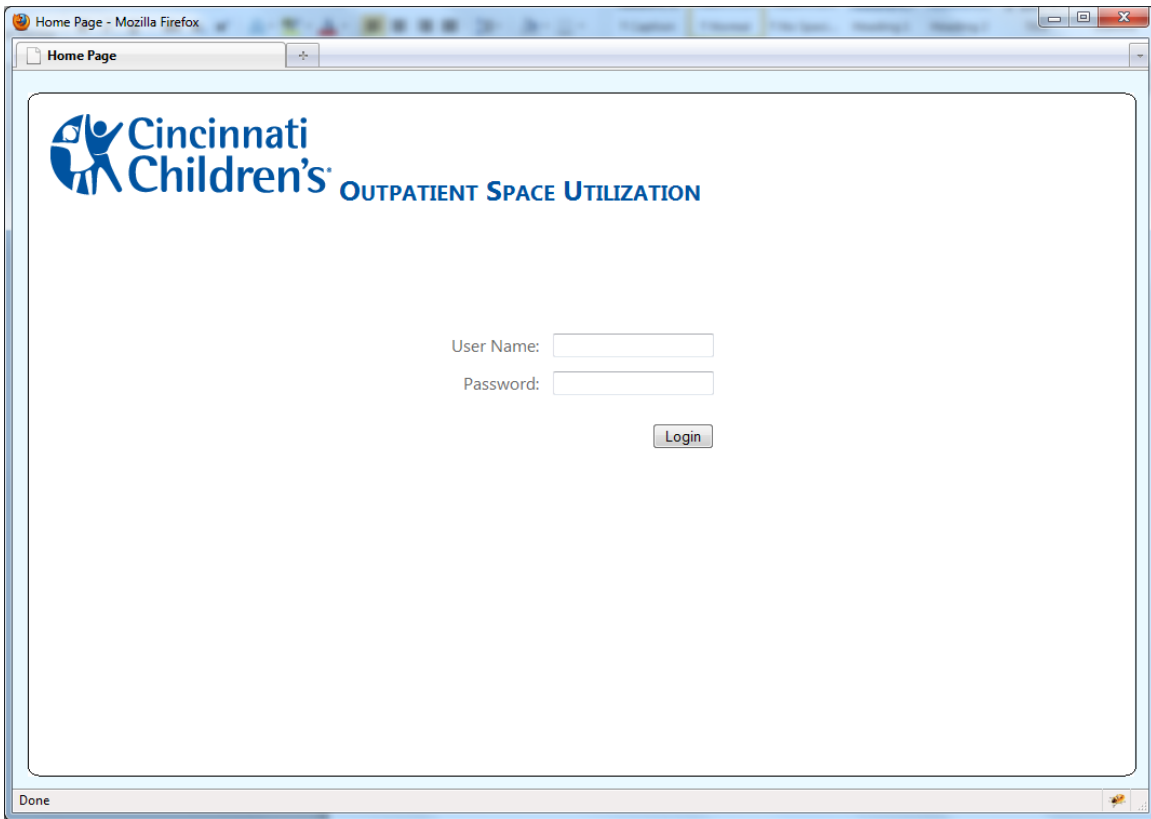


Figure 12. Main login screen

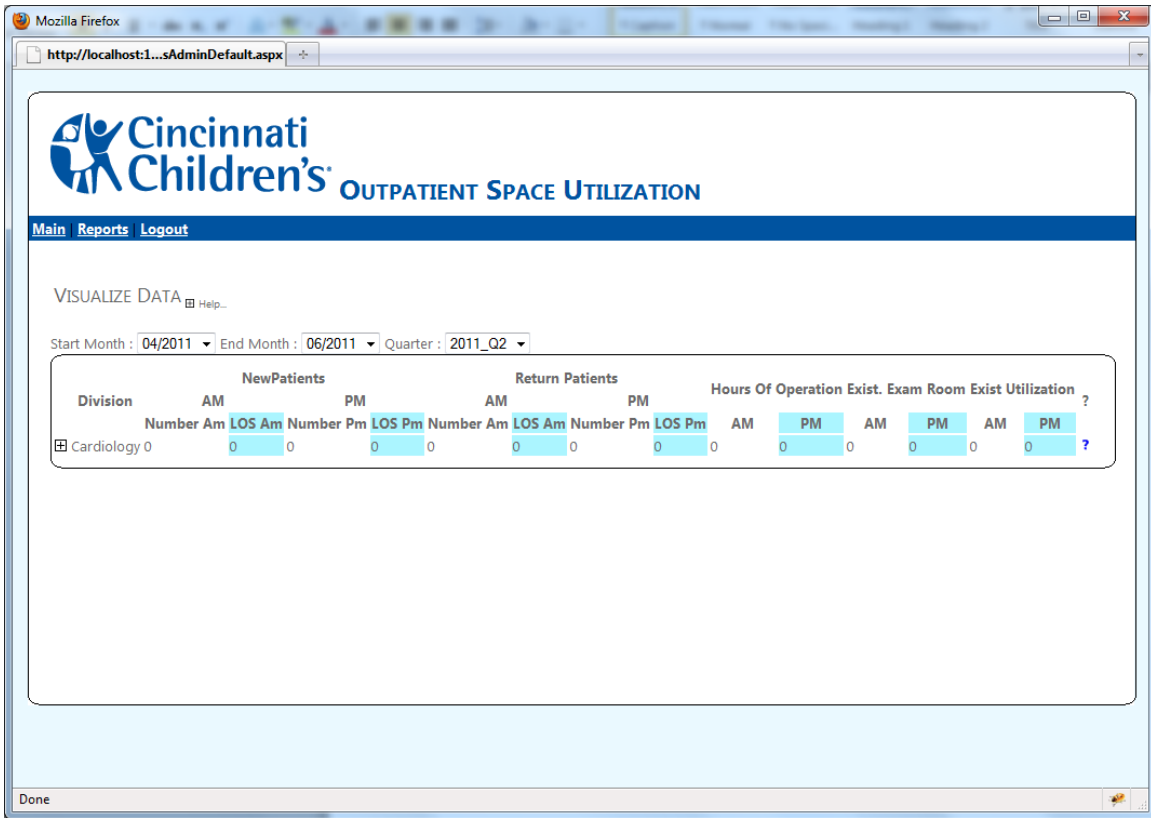


Figure 13. Landing page for Business Directors

Recall that the interest Business Administrators have in this application is viewing the outpatient exam room utilization of their respective division(s). In this case the Director of Cardiology is logged in, and as shown in the figure above, the first thing they see upon logging in is utilization data. They can only view data from the division or divisions for which they have access. Access controls and privileges are controlled by the System Administrator and will be explained later.

Notice that the user has options for viewing the data. First, they can change the date range by selecting months or quarters. Secondly, they have the ability to drilldown into the division(s) to gain finer granularity and filtering of the data. For example, Figure

14 shows the results when the date range is extended to the first six months of 2011, and the drilldown is expanded. By default, only the current quarter's data is shown.

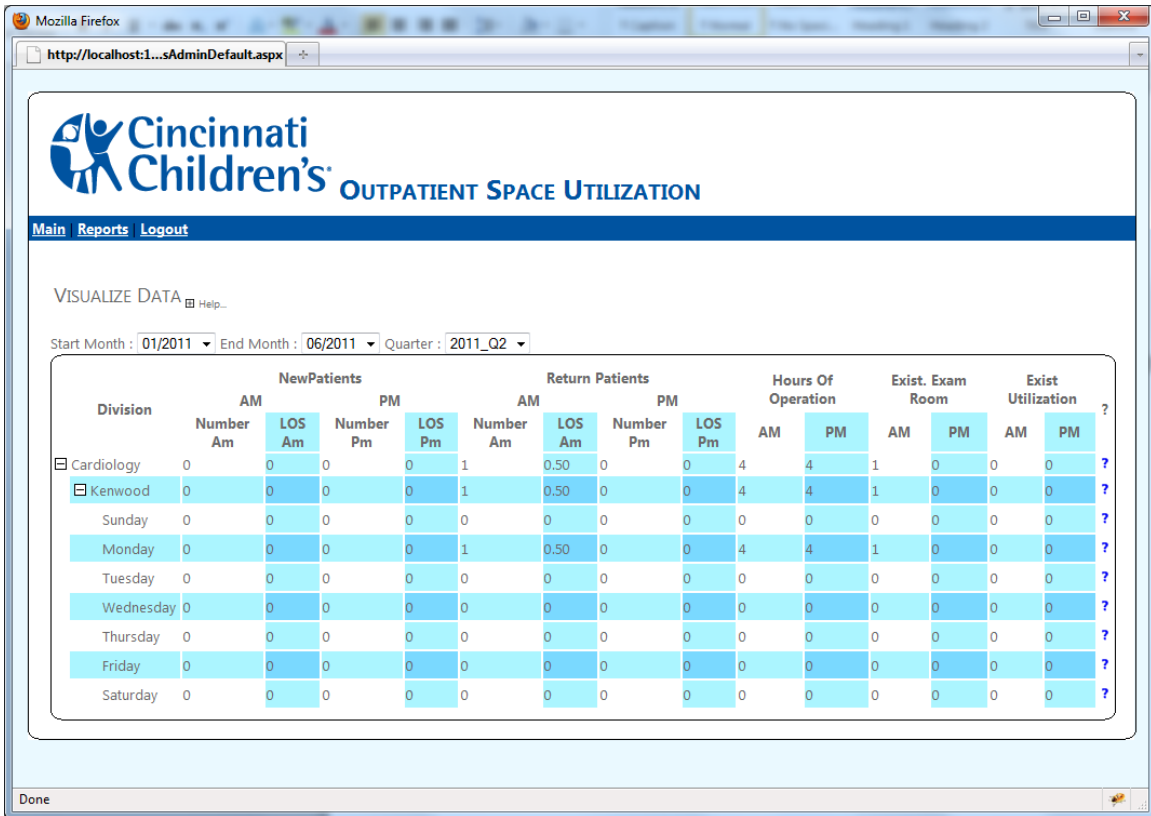


Figure 14. Expanded data view for Director of Cardiology

The user (Director of Cardiology) can choose to generate a report by clicking the *Reports* link in the upper left of the dark blue navigation panel. This takes them to a screen where this can be accomplished. It is shown in Figure 15.

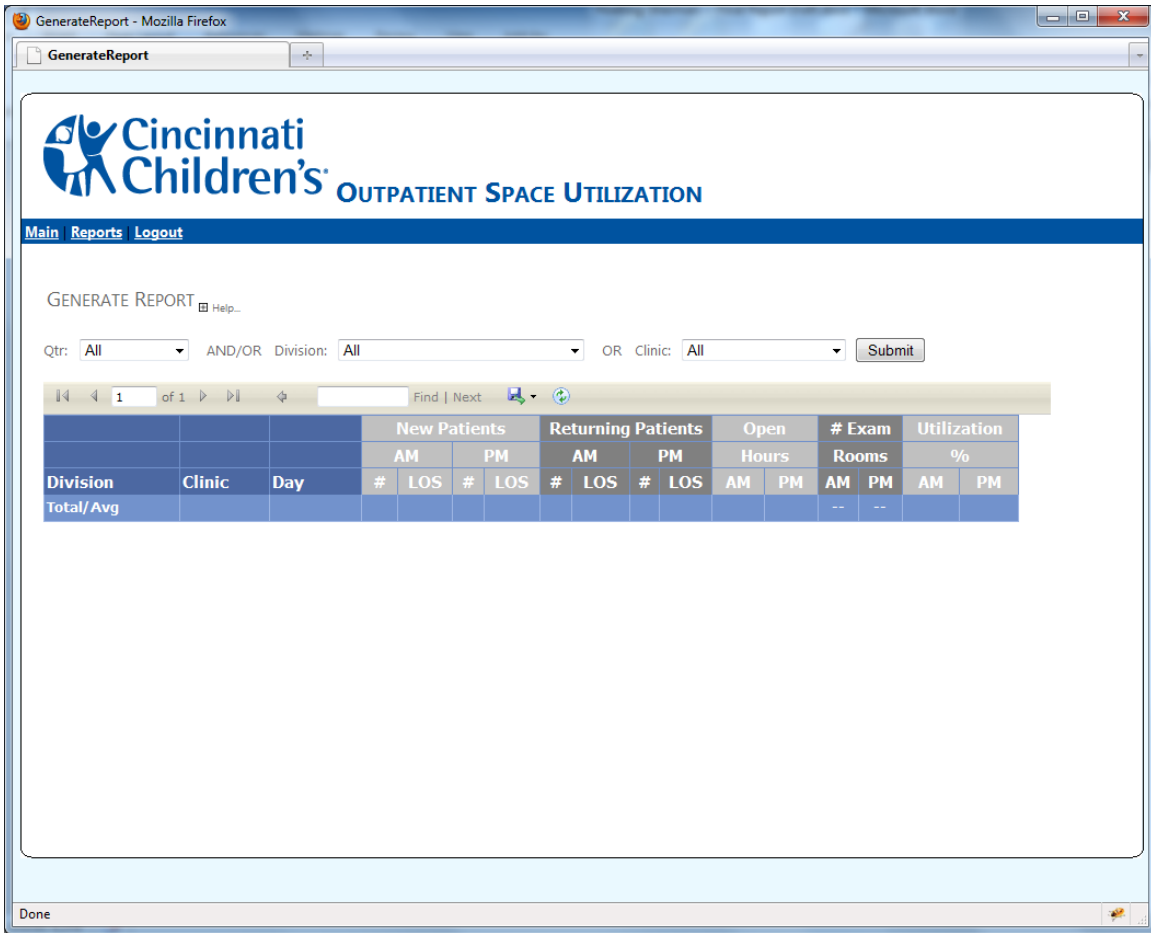


Figure 15. Reporting page

The report shows the fields for the table to be built, but is not yet populated with data. Data is populated when the user chooses their report criteria and presses *Submit*. Choices for criteria include a reporting quarter, and/or a specific division or clinic. Alternatively, and by default, the criteria selections are set to *All*. Figure 16 shows the option pull-down menus.

Qtr: AND/OR Division: OR Clinic:

Division: Clinic:

Figure 16. Reporting criteria

Once the criteria are submitted, the report populates with the relevant data.

GenerateReport - Mozilla Firefox

GenerateReport

Cincinnati Children's OUTPATIENT SPACE UTILIZATION

Main Reports Logout

GENERATE REPORT

Qtr: AND/OR Division: OR Clinic:

1 of 1 Find | Next

Division	Clinic	Day	New Patients		Returning Patients		Open		# Exam		Utilization					
			#	LOS	#	LOS	#	LOS	AM	PM	AM	PM	AM	PM		
Cardiology	Total		0	0.00	0	0.00	1	0.50	0	0.00	4.00	0.00	--	--	13	0
	Kenwood	Total	0	0.00	0	0.00	1	0.50	0	0.00	4.00	0.00	1	0	13	0
		Monday	0	0.00	0	0.00	1	0.50	0	0.00	4.00	0.00	1	0	13	0
Total/ Avg			0	0.00	0	0.00	1	0.50	0	0.00	4.00	0.00	--	--	13	0

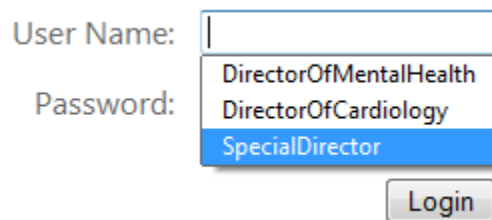
Done

Figure 17. Generated report

As shown above in Figure 17, data included for the Director of Cardiology shows that there was only one outpatient visit. This is intended to allow the reader to clearly see how the data is aggregated. In the example above, the one patient visit occurred on a Monday morning, and it was for a returning patient. The specific dates of services are not important to Business Directors, only the aggregation by division, clinic and the day of the week.

The length of stay (LOS) or cycle time of the patient's visit was ½ of an hour. On that day, Kenwood's facility had one exam room available for 4 hours in the morning treating patients for the Cardiology Division. Therefore, the total utilization for the Cardiology Division at the Kenwood Clinic on Mondays is 12.5%, which is rounded to 13%.

Now that the basic calculations have been explained let us login as a different user to view more realistic data and explore some additional functionality (Figure 18).



The image shows a login interface with two input fields: 'User Name:' and 'Password:'. The 'User Name' field is empty. The 'Password' field has a dropdown menu open, showing three options: 'DirectorOfMentalHealth', 'DirectorOfCardiology', and 'SpecialDirector'. The 'SpecialDirector' option is highlighted in blue. Below the dropdown is a 'Login' button.

Figure 18. Logging in as Special Director

The Special Director account has privileges to view utilization data from multiple divisions. See Figure 19.

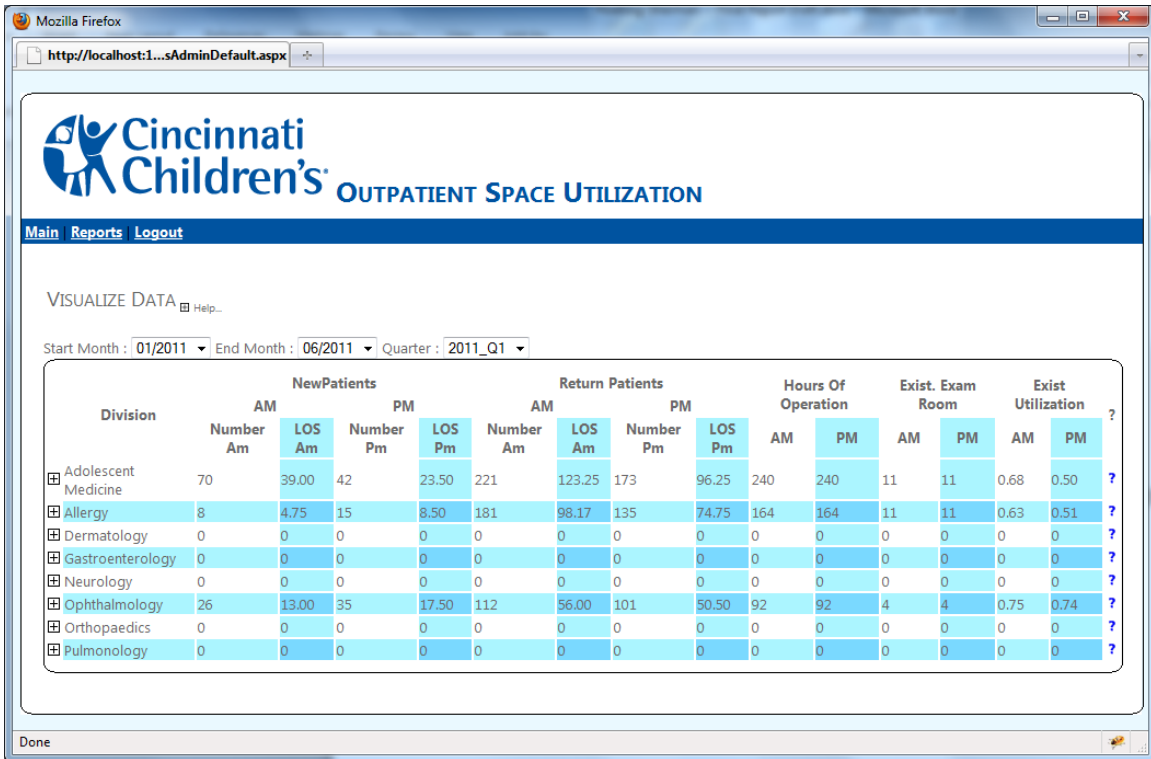


Figure 19. Landing page for Special Director

Notice that sample data has been populated for three divisions during the time period of January through June of 2011: Adolescent Medicine, Allergy and Ophthalmology. By expanding the help control, the user is directed to click the question mark icon on the right side of the data grid in order to perform what-if analysis. With the ability to do perform what-if analysis users are able to learn which parameter values result in an acceptable utilization rate. See Figure 20.

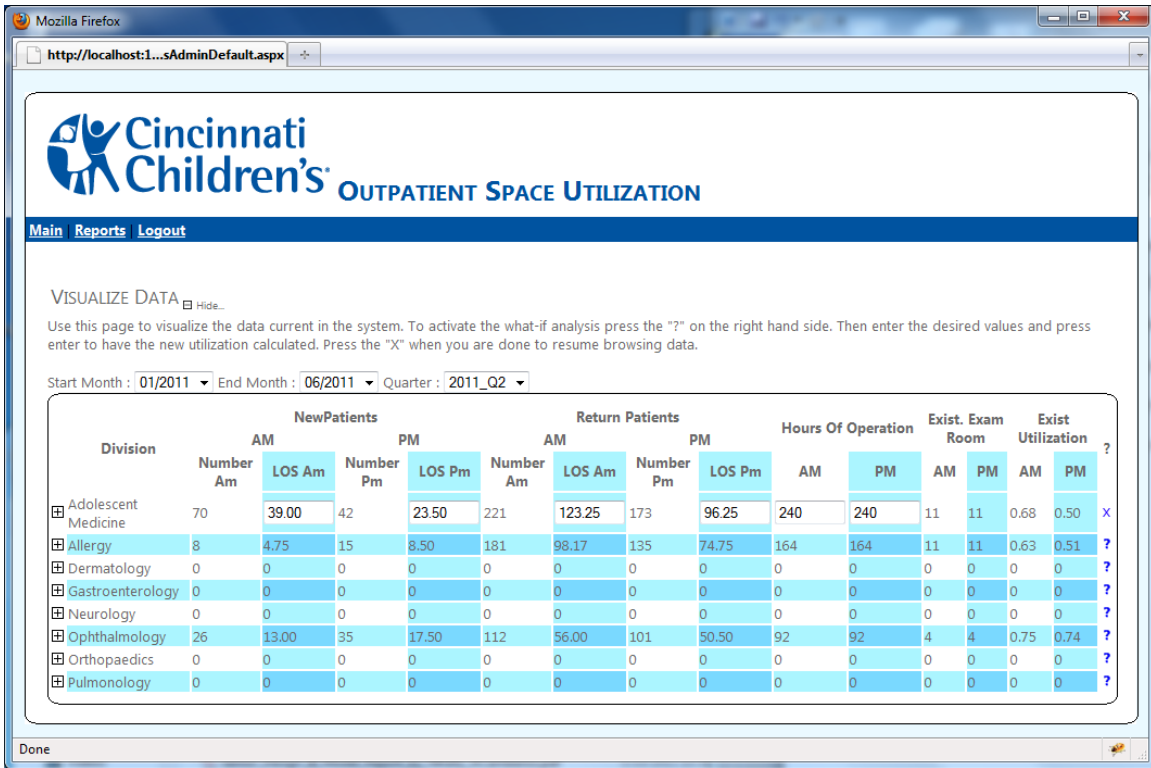


Figure 20. Help feature enabled and “what-if” mode activated

Focus on the afternoon utilization rate for the Division of Adolescent Medicine. Currently, it shows a value of 50%. Suppose that the user wants to achieve a rate of 75% occupancy for this division. They can alter any of the values in edit mode to arrive at this figure. Figure 21 shows the new percentage after the number of available afternoon hours has been changed to 160.

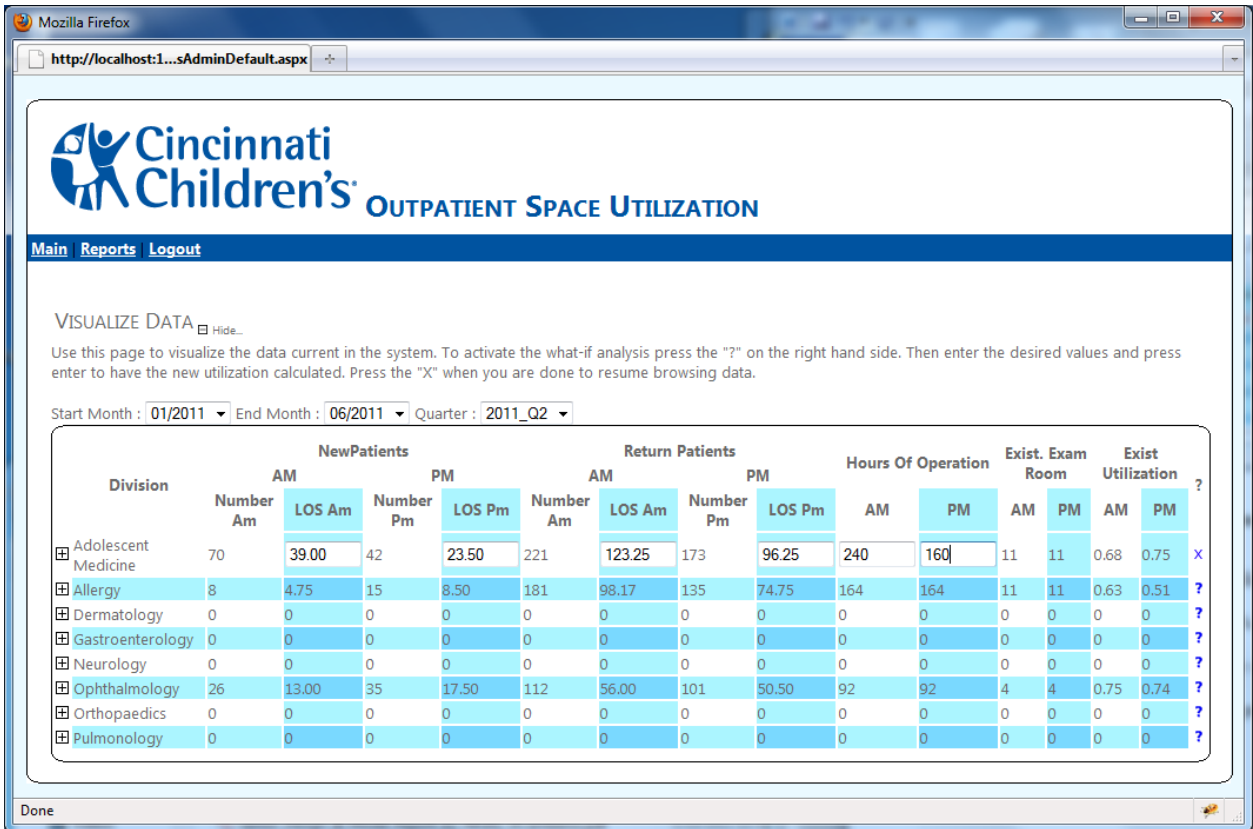


Figure 21. Utilization change after editing a parameter value

After clicking the X icon on the right of the changed data row and collapsing the help text the user arrives back at the original view shown in Figure 19.

As mentioned earlier, much of the data analysis regarding outpatient exam room utilization has been performed using spreadsheets. In the next scenario, suppose the user now wants to generate a report for the Division of Adolescent Medicine. They would click on *Reports* in the navigation panel, select Adolescent Medicine from the dropdown menu and click on the *Submit* button. The results of these actions return the report in Figure 22.

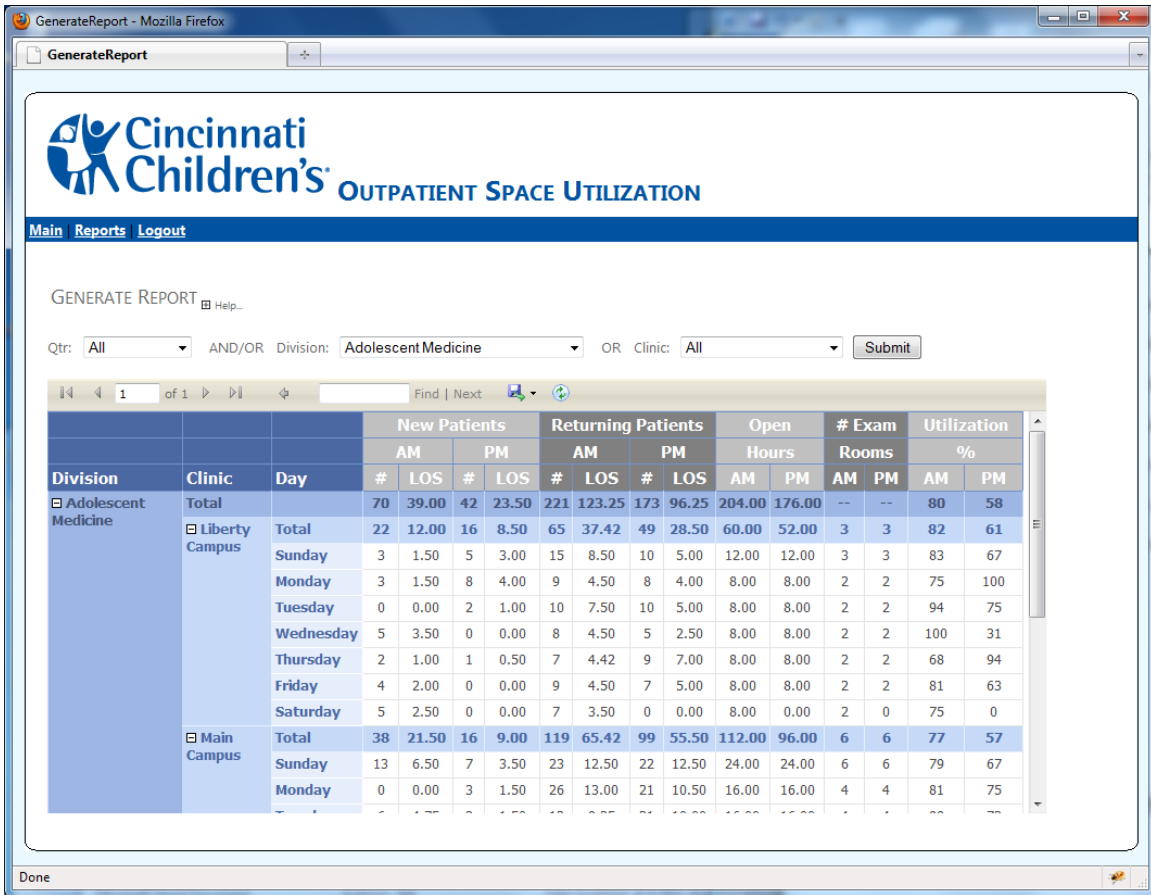


Figure 22. Report generated for the Division of Adolescent Medicine

To export the report the user needs only to select the small dropdown arrow near the disk icon to choose an output file format (Figure 23).

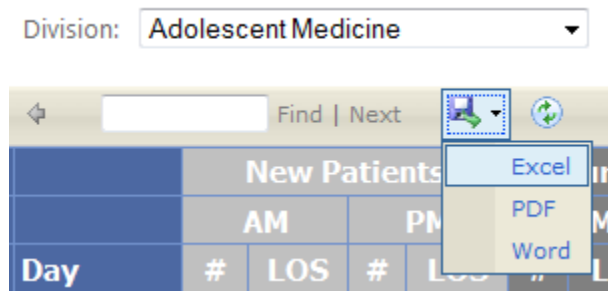


Figure 23. Exporting report

Upon choosing Excel, a dialog box pops up giving the option to open or save the document (Figure 24).

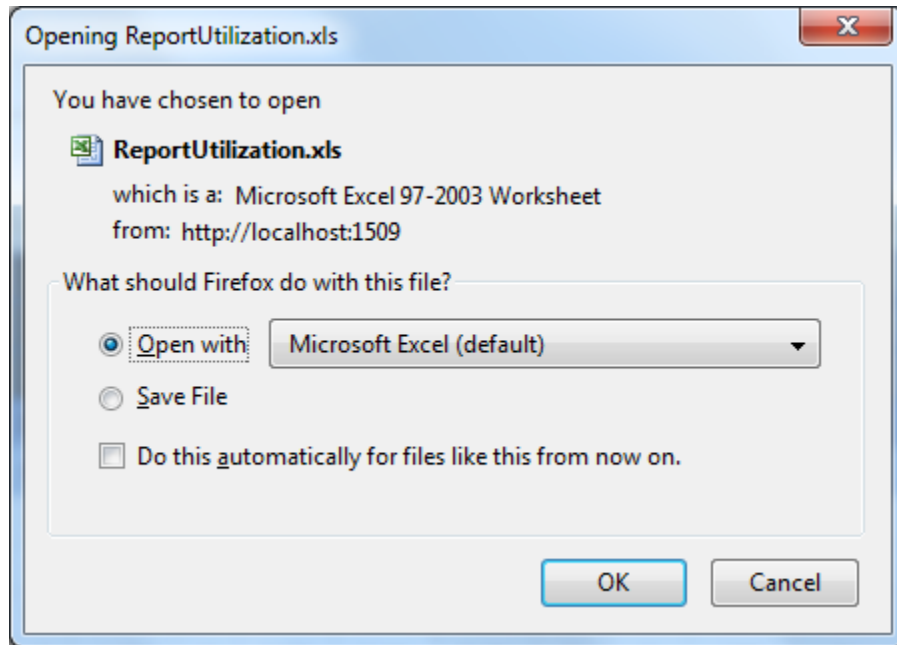


Figure 24. Exporting report to Excel

Having the ability to export reports give the users of the application the flexibility to share information with others that do not have access to the application (e.g. emailing) and only have office applications to examine reports. But, data integrity is still maintained because it is securely stored in the application database. Figure 25 shows the report now opened in an Excel file.

	Division	Clinic	Day	New Patients				Returning Patients				Open		# Exam		Utilization	
				#	LOS	#	LOS	#	LOS	#	LOS	AM	PM	AM	PM	AM	PM
1																	
2																	
3	Adolescent Medicine	Liberty Campus	Total	70	39.00	42	23.50	221	123.25	##	96.25	####	176.00	--	--	80	58
4			Sunday	3	1.50	5	3.00	15	8.50	10	5.00	12.00	12.00	3	3	83	67
5			Monday	3	1.50	8	4.00	9	4.50	8	4.00	8.00	8.00	2	2	75	100
6			Tuesday	0	0.00	2	1.00	10	7.50	10	5.00	8.00	8.00	2	2	94	75
7			Wednesday	5	3.50	0	0.00	8	4.50	5	2.50	8.00	8.00	2	2	100	31
8			Thursday	2	1.00	1	0.50	7	4.42	9	7.00	8.00	8.00	2	2	68	94
9			Friday	4	2.00	0	0.00	9	4.50	7	5.00	8.00	8.00	2	2	81	63
10			Saturday	5	2.50	0	0.00	7	3.50	0	0.00	8.00	0.00	2	0	75	0
11			Total	38	21.50	16	9.00	119	65.42	99	55.50	####	96.00	6	6	77	57
12			Sunday	13	6.50	7	3.50	23	12.50	22	12.50	24.00	24.00	6	6	79	67
13			Monday	0	0.00	3	1.50	26	13.00	21	10.50	16.00	16.00	4	4	81	75
14			Tuesday	6	4.75	3	1.50	12	9.25	21	10.00	16.00	16.00	4	4	88	72
15			Wednesday	3	1.50	1	0.50	18	10.50	8	4.00	16.00	16.00	4	4	75	28
16			Thursday	4	2.75	1	1.50	5	2.67	21	14.00	8.00	16.00	2	4	68	97
17			Friday	4	2.00	1	0.50	23	11.50	6	4.50	16.00	8.00	4	2	84	63
18			Saturday	8	4.00	0	0.00	12	6.00	0	0.00	16.00	0.00	4	0	63	0
19			Total	10	5.50	10	6.00	37	20.42	25	12.25	32.00	28.00	2	2	82	56
20			Sunday	4	2.00	4	2.00	8	4.00	6	3.00	8.00	8.00	2	2	75	63
21			Monday	0	0.00	2	1.00	8	4.00	6	3.00	4.00	4.00	1	1	100	100
22			Tuesday	3	2.00	0	0.00	2	1.75	6	2.75	4.00	4.00	1	1	94	69
23			Wednesday	0	0.00	1	0.50	6	4.00	2	1.00	4.00	4.00	1	1	100	38
24			Thursday	1	0.50	3	2.50	4	2.17	3	1.50	4.00	4.00	1	1	67	100
25			Friday	0	0.00	0	0.00	7	3.50	2	1.00	4.00	4.00	1	1	88	25
26			Saturday	2	1.00	0	0.00	2	1.00	0	0.00	4.00	0.00	1	0	50	0
27			Total/Avg	70	39.00	42	23.50	221	123.25	##	96.25	####	176.00	--	--	80	58

Figure 25. Report opened in Excel

Now, let us turn our attention to the other type of users, System Administrators.

These folks are individuals who maintain the data in the application. If we were to log in as an administrator, we would see the following screen (Figure 26).

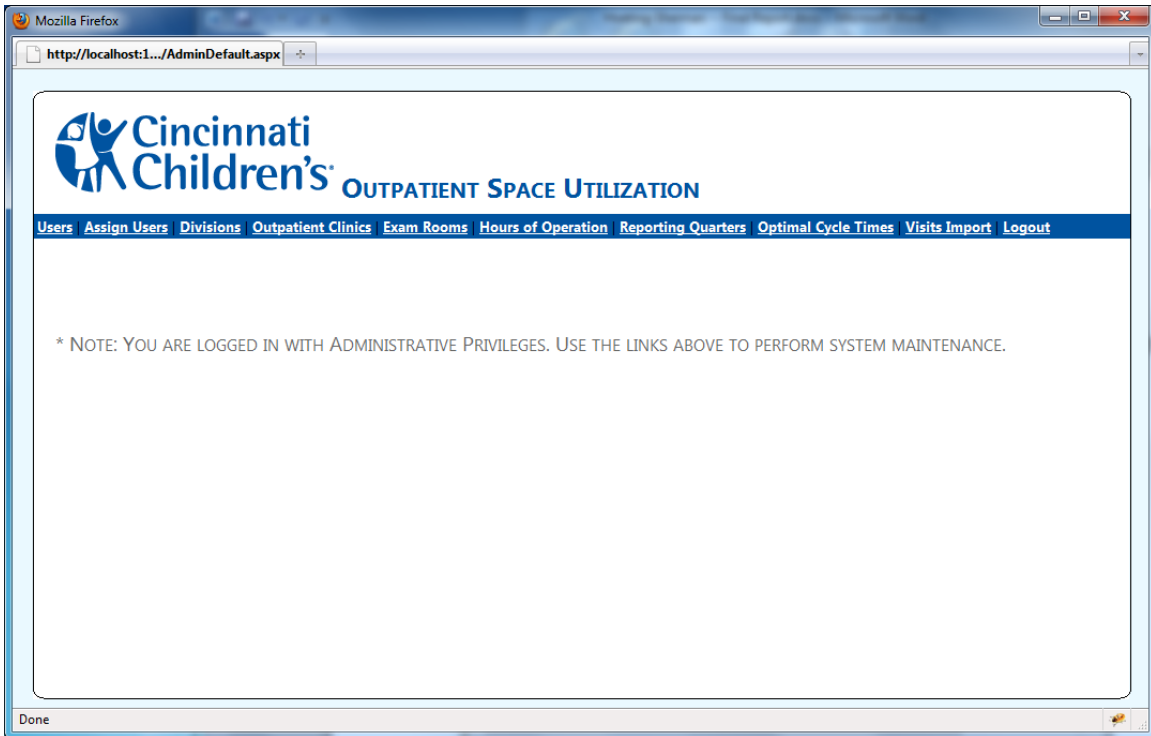


Figure 26. Landing page for System Administrators

One of the first things a System Administrator might do is create a new user. The *Users* link in the navigation panel takes them to the page shown in Figure 27 where they can accomplish this task along with others that enable them to maintain user data.

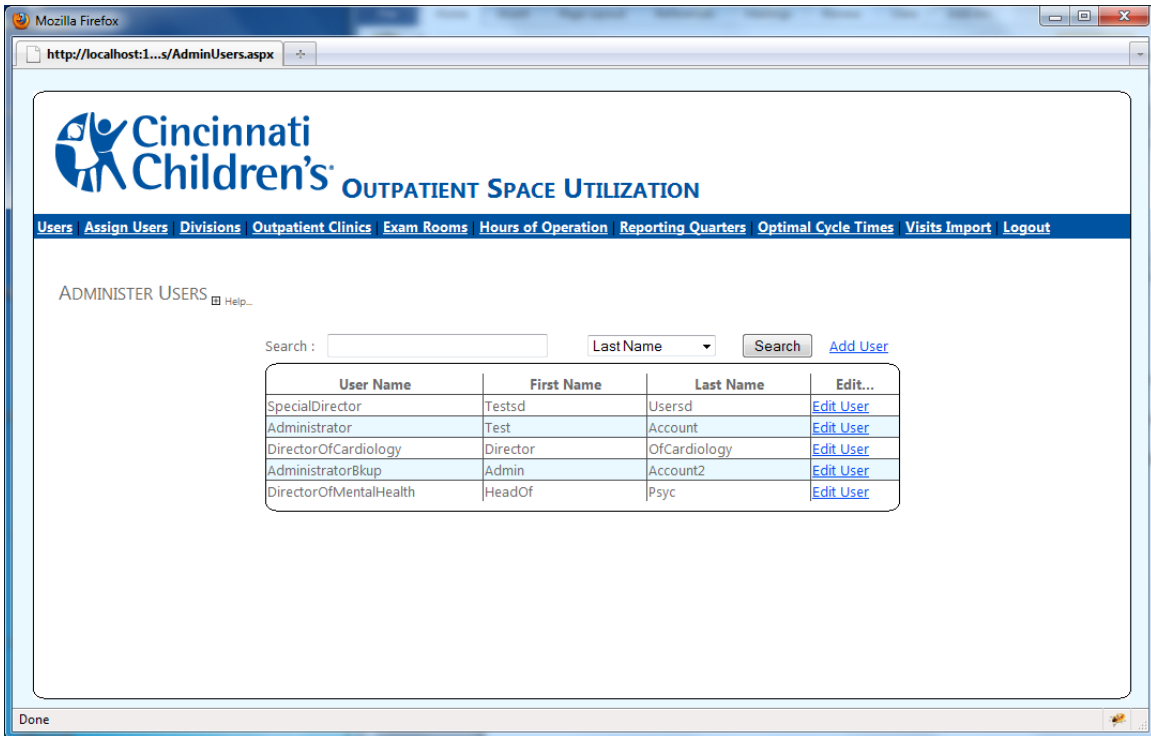


Figure 27. Users page: Enables maintenance of users

Before we create a new user, let us explore the search features in the application because they are used throughout the web pages that the System Administrator uses. The System Administrator or SA can choose to search users by user name, first name or last name. This feature is very useful when many users exist in the database. Using Figure 27 above as a reference, let us search by last name for the user with the last name of “Psyc”. See Figure 28.

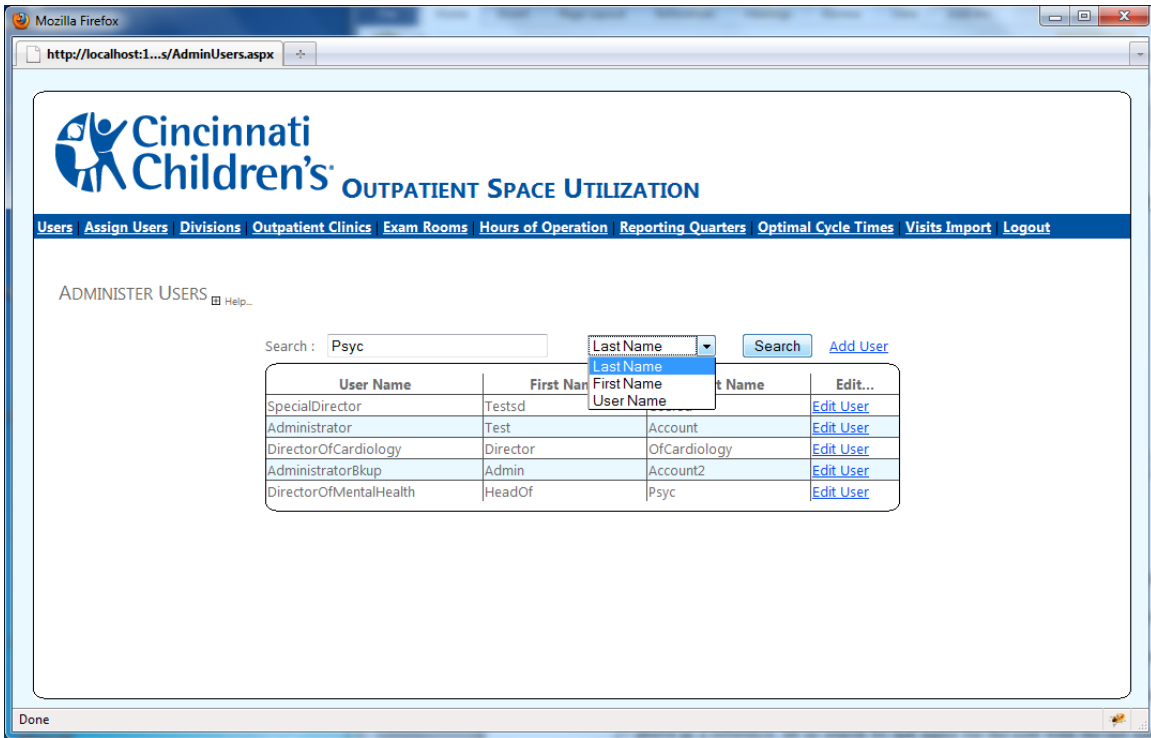


Figure 28. Using search feature

Once the *Search* button is clicked, the user records are filtered, and the only user returned is the Director of Mental Health. See Figure 29.

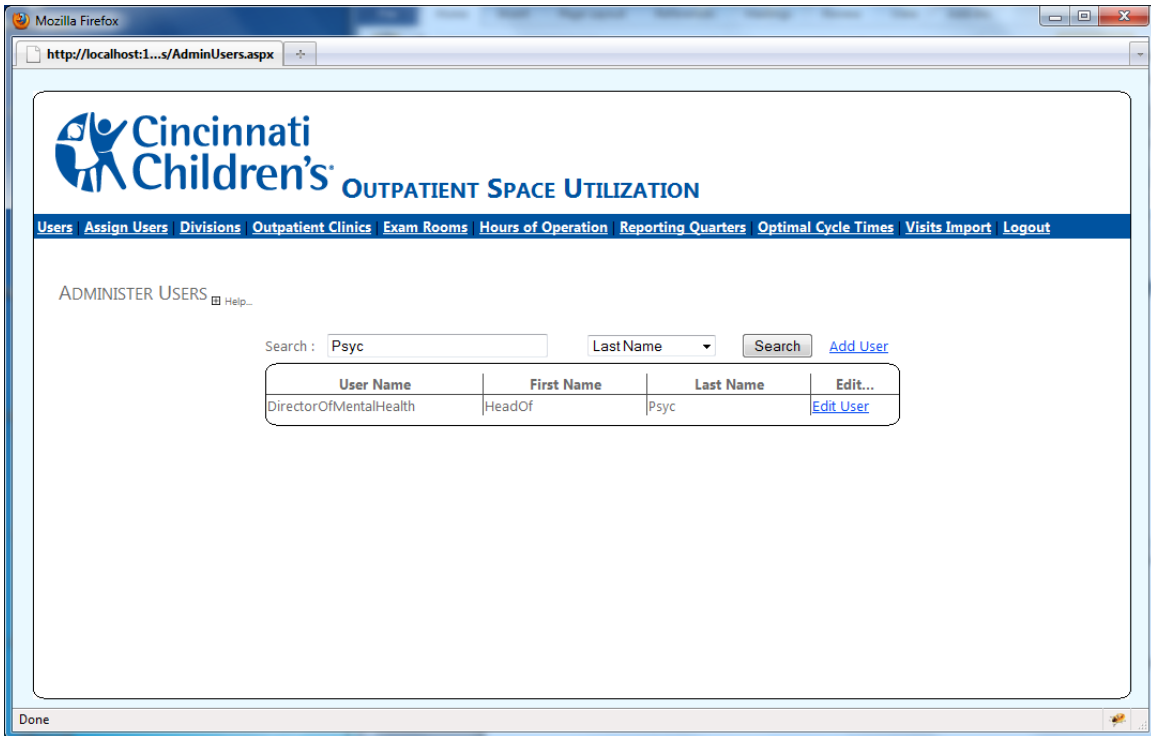


Figure 29. Search results using search feature

Adding and editing data on the various SA pages that list data in grids is accomplished through the same modal pop-up windows. We illustrate it fully here; it works in the same way on other pages. For example, by clicking the blue *Edit User* link on the right of the Director of Mental Health record, we see the following window.

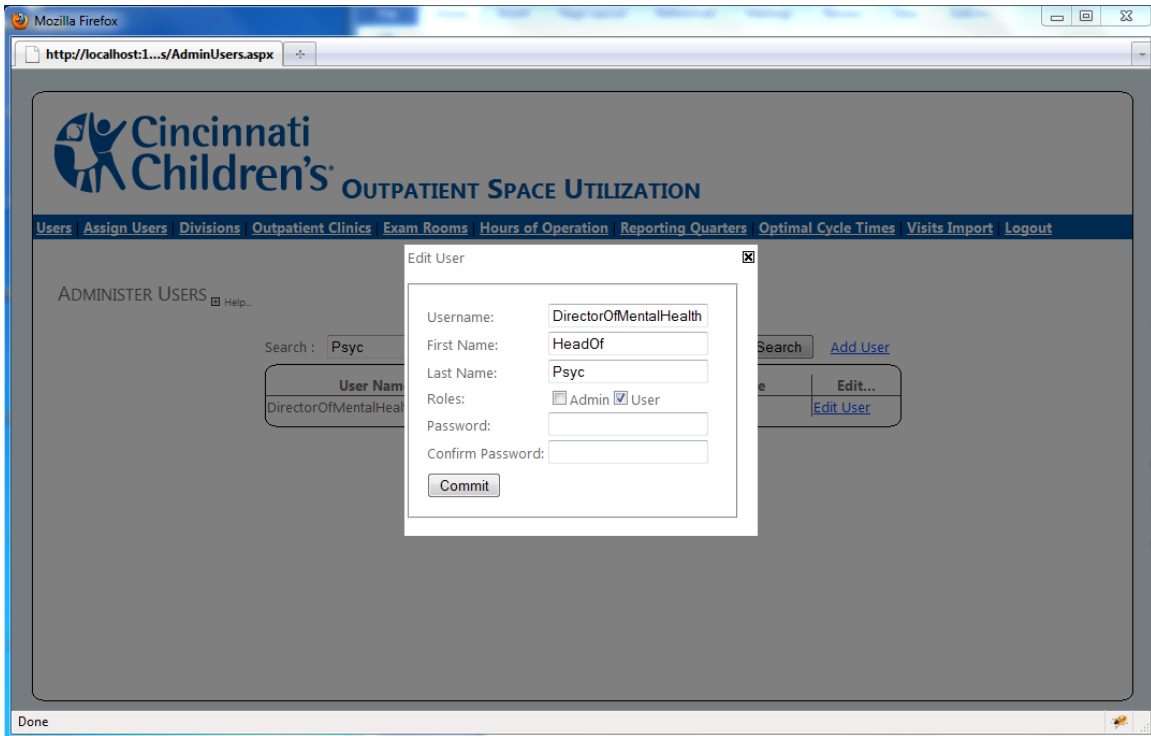
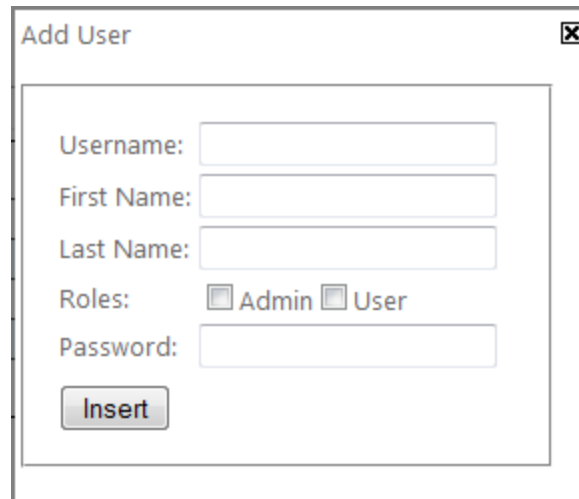


Figure 30. Modal pop-up window for editing records

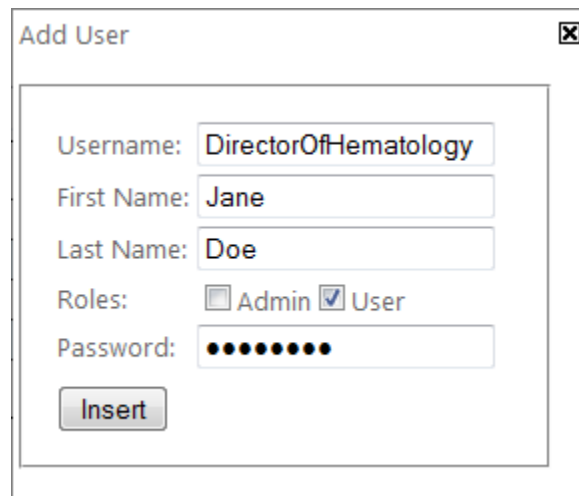
The main difference between adding and editing a record is that when editing a record, all record data is prepopulated in the modal dialog box. If we were to exit this dialog and add a new user via the blue *Add User* link, we would see the dialog as shown in Figure 31.



The image shows a dialog box titled "Add User" with a close button in the top right corner. Inside the dialog, there are five input fields: "Username:", "First Name:", "Last Name:", "Roles:", and "Password:". The "Roles:" field contains two radio buttons, "Admin" and "User", both of which are unselected. Below the input fields is an "Insert" button.

Figure 31. Empty add user dialog box

Then, if we were to add the following information in the dialog and click the *Insert* button as follows...



The image shows the same "Add User" dialog box, but now it is populated with data. The "Username:" field contains "DirectorOfHematology", "First Name:" contains "Jane", "Last Name:" contains "Doe", and the "Password:" field contains ten black dots. The "Roles:" field now has the "Admin" radio button unselected and the "User" radio button selected. The "Insert" button remains at the bottom.

Figure 32. Populated add user dialog box

...we would see the newly created user in the record list as shown in Figure 33.

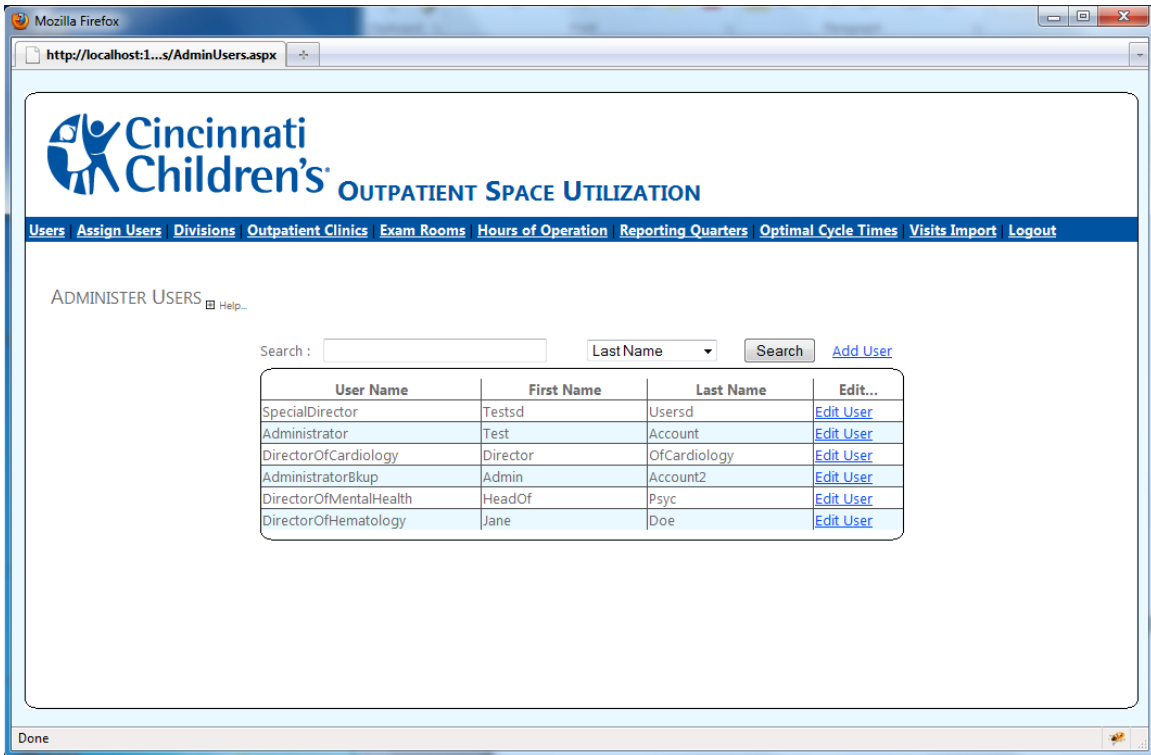


Figure 33. New user added to database

Before confirming that the new user account for the Director of Hematology was added and is functional, let us perform a few more tasks. First, we need to assign privileges for this user. We will allow this user to only view data for the Division of Hematology/ Oncology. So, the SA would click the Assign Users link in the navigation panel and arrive at the following page.

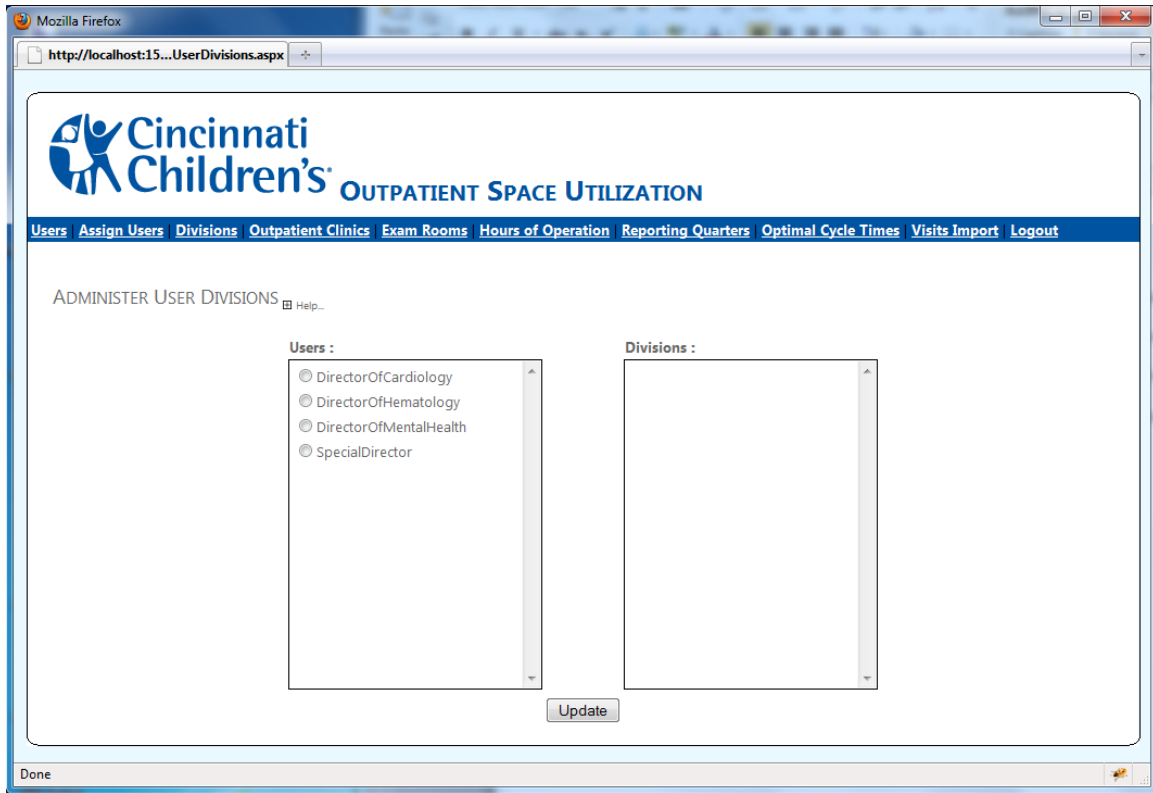


Figure 34. Assign users page to set viewing permissions

In order to view and edit divisions that a user has rights to, the SA simply selects the radio button beside the user they wish to grant permissions, and the list of divisions is populated to the right. In Figure 35, the user was chosen and the appropriate division was checked.

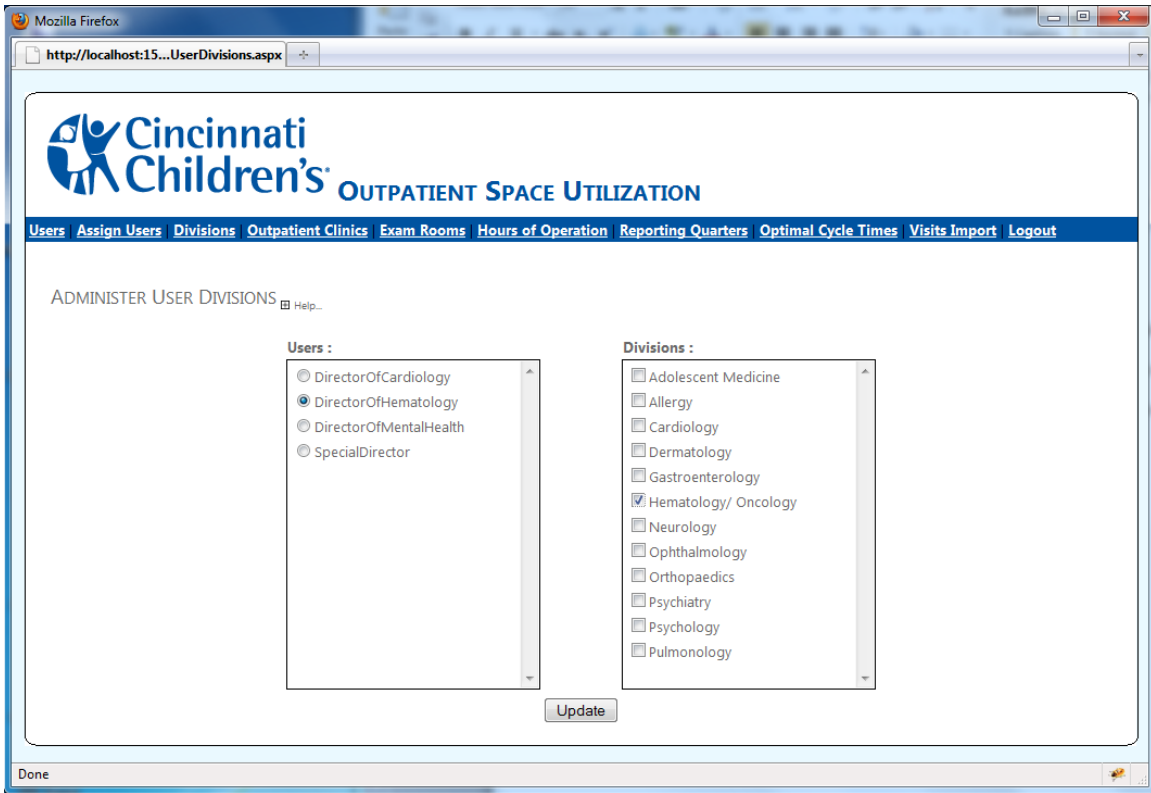


Figure 35. Assigning divisions to users

Figure 36 shows an example of what the SA would see if they had chosen a user with existing permissions.

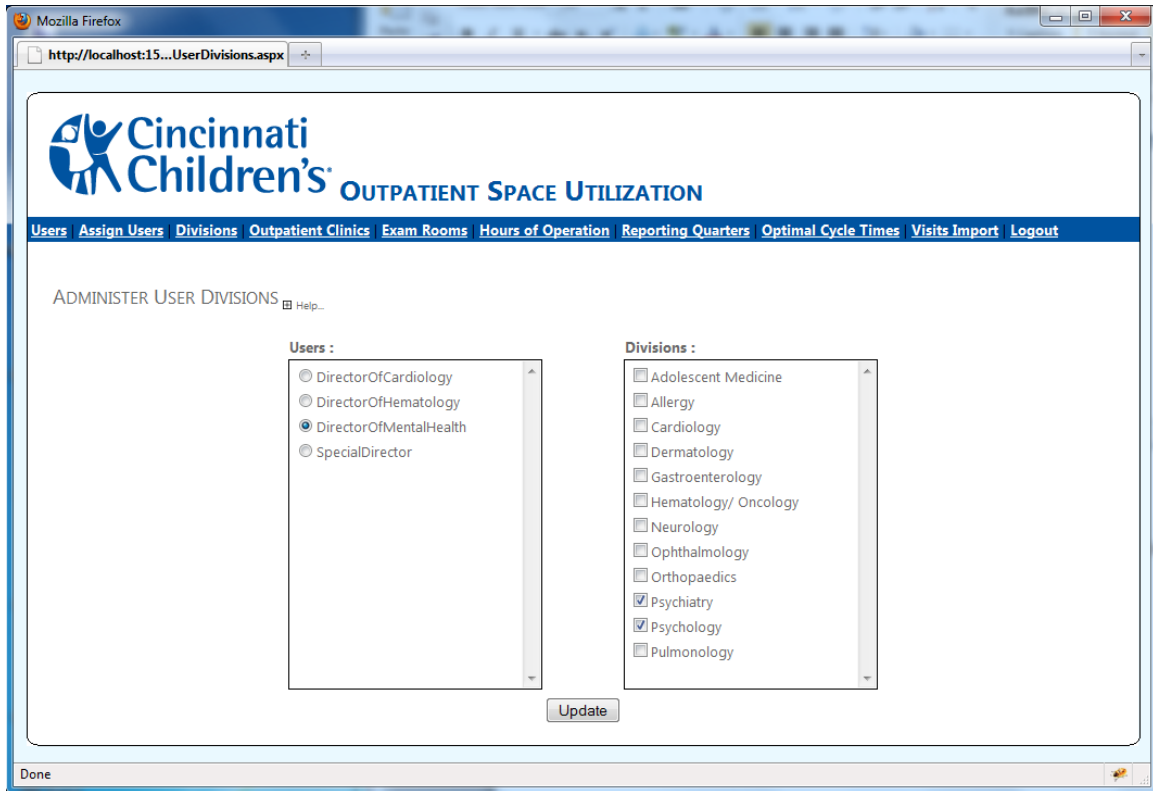


Figure 36. Showing existing user viewing permissions

Any time a change is made by checking or unchecking a checkbox on the right, the data is submitted to the database by clicking the *Update* button.

Next, let us access the *Divisions* page to assign a clinic out of which the Division of Hematology/ Oncology can operate. See Figure 37.

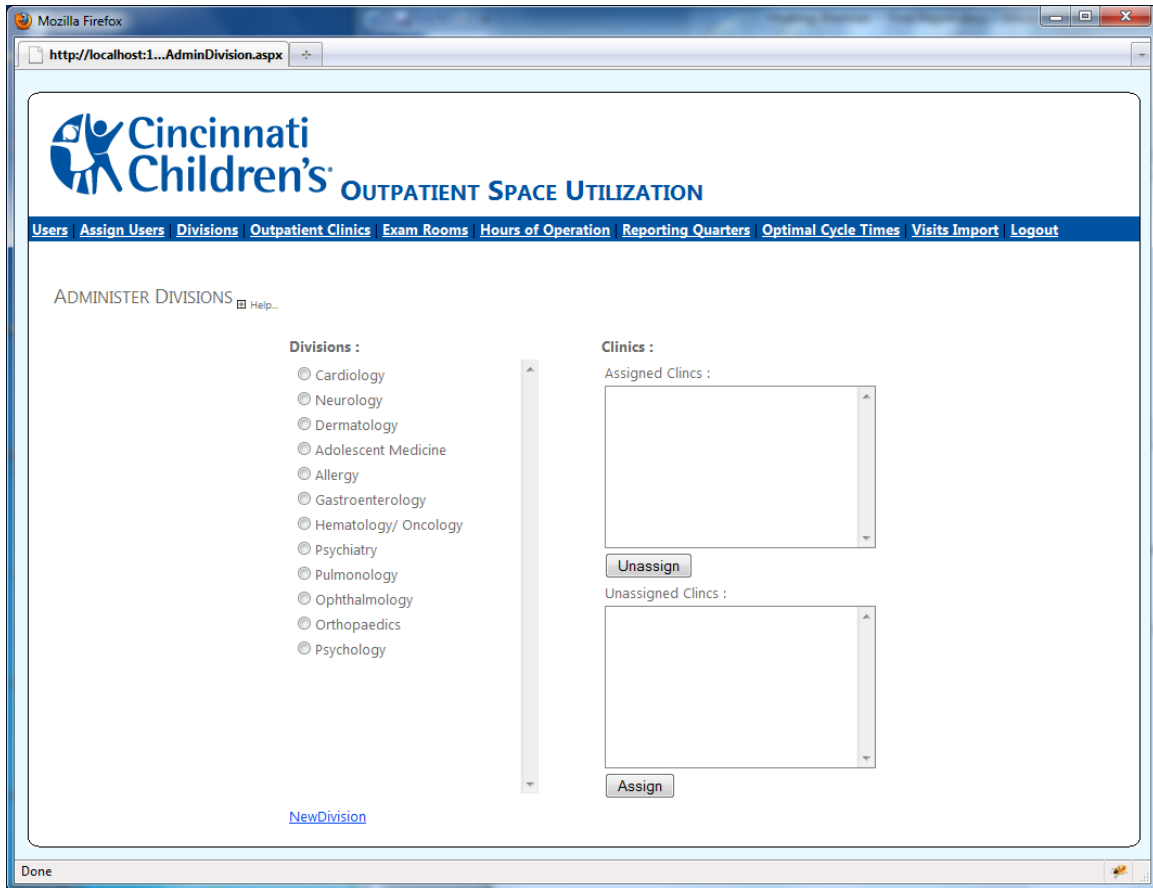


Figure 37. Assigning clinics to a division

Similar to the previous page, the SA simply has to choose a division on the left to view assigned clinics on the right. To continue on with our scenario of the newly created Director of Hematology/ Oncology user, let us click on that division. This will show that no clinics have yet been assigned to service that division. In Figure 38, we will select the Kenwood Clinic from the *Unassigned Clinics* box and click *Assign*.

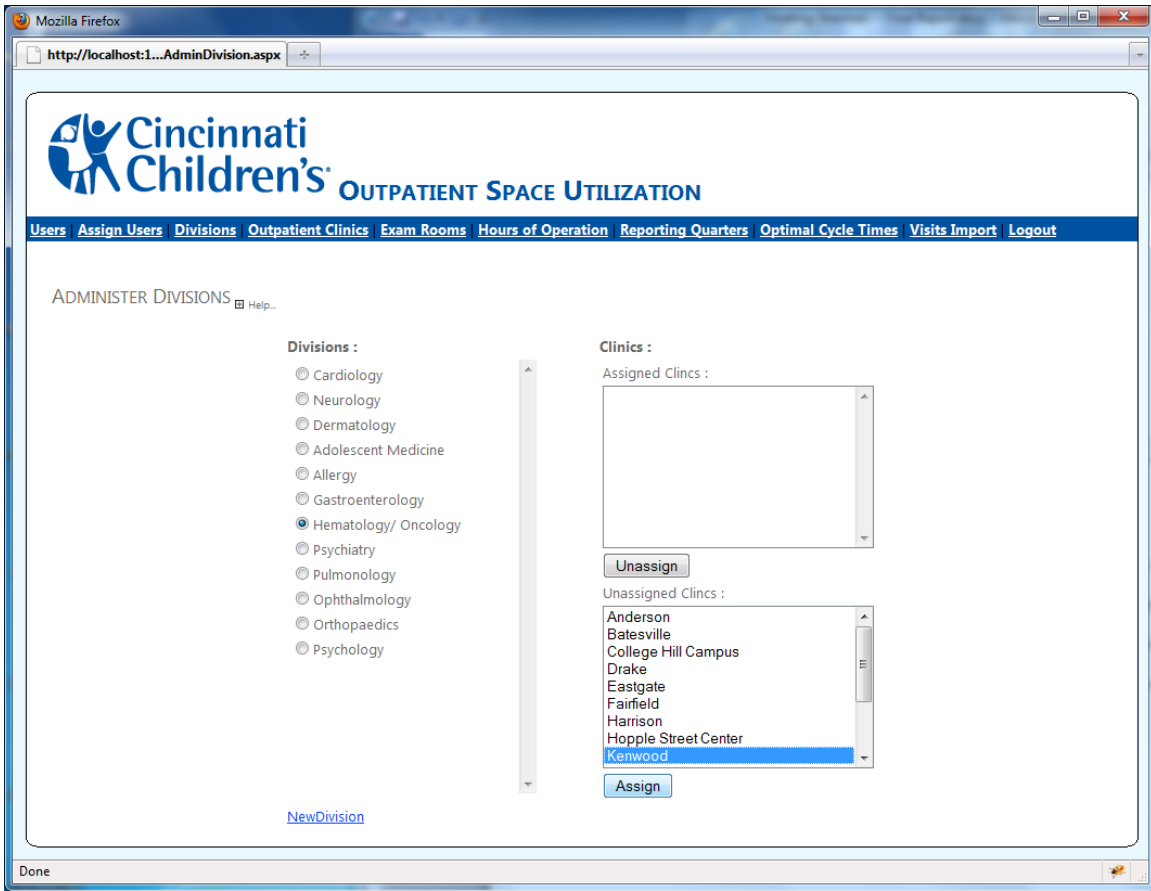


Figure 38. Assigning the Kenwood Clinic to Hematology / Oncology

This action results in the Kenwood Clinic appearing in the *Assigned Clinics* box, and associating those two entities in the database (Figure 39).

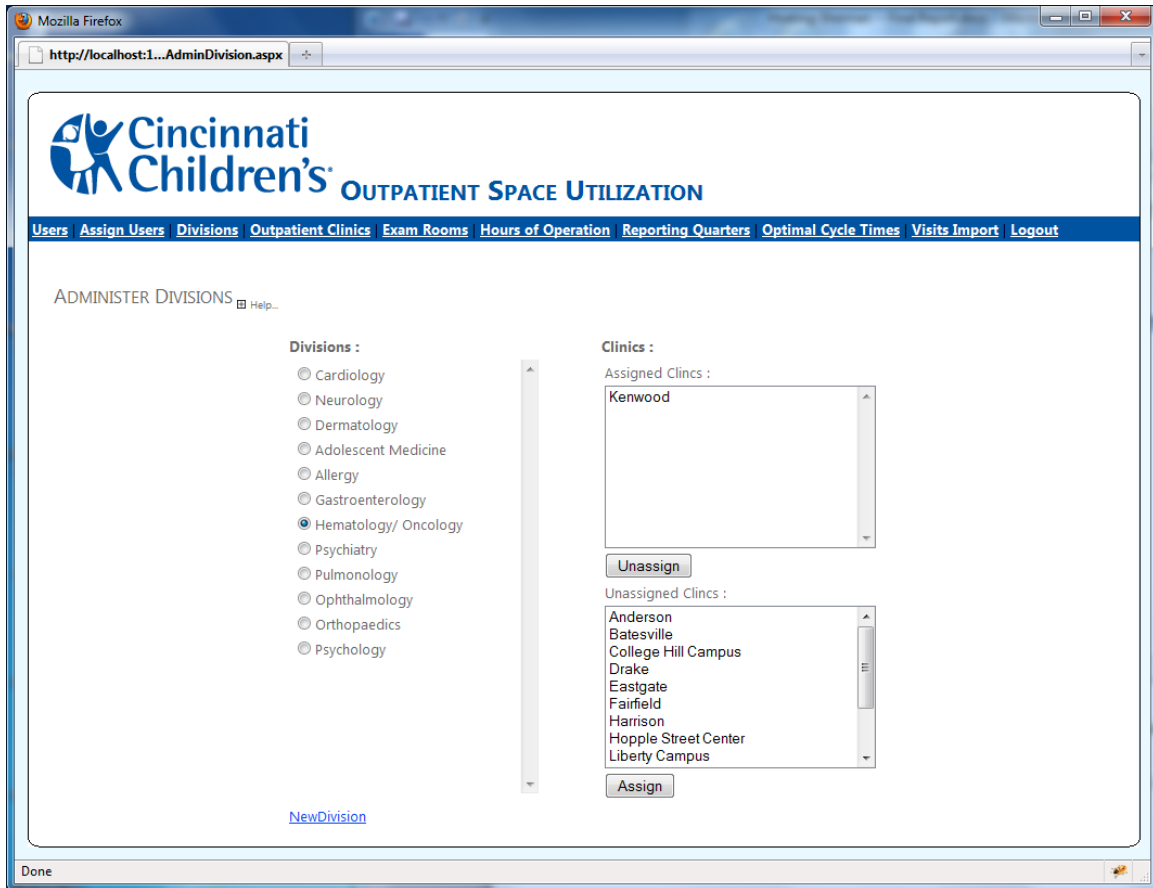


Figure 39. Kenwood Clinic now assigned to Hematology / Oncology

Next, let us import patient visit data for the Division of Hematology/ Oncology. Recall that this data originates in EPIC, CCHMC's medical records system. To do this, the SA navigates to the *Visits Import* page. It is here, that records can be imported into the database.

The batch import tool loads a comma-separated values (.csv) file. This is the data that will be added and edited most frequently and in greatest quantity. The System Administrator will need to be able to alter information about Users, Divisions, Outpatient Clinics, Exam Rooms, Hours of Operation, Reporting Quarters and Optimal Cycle Times only occasionally. Therefore, it can be accomplished manually. However,

over a number of weeks or months, hundreds or thousands of patient visits may occur, prompting a need for a tool to import that data into the database.

The data originates in EPIC but there is no integration ability for the group with whom we are working at CCHMC. So, they have to request authorization for bulk extracts from EPIC in order to transfer that data into the application.

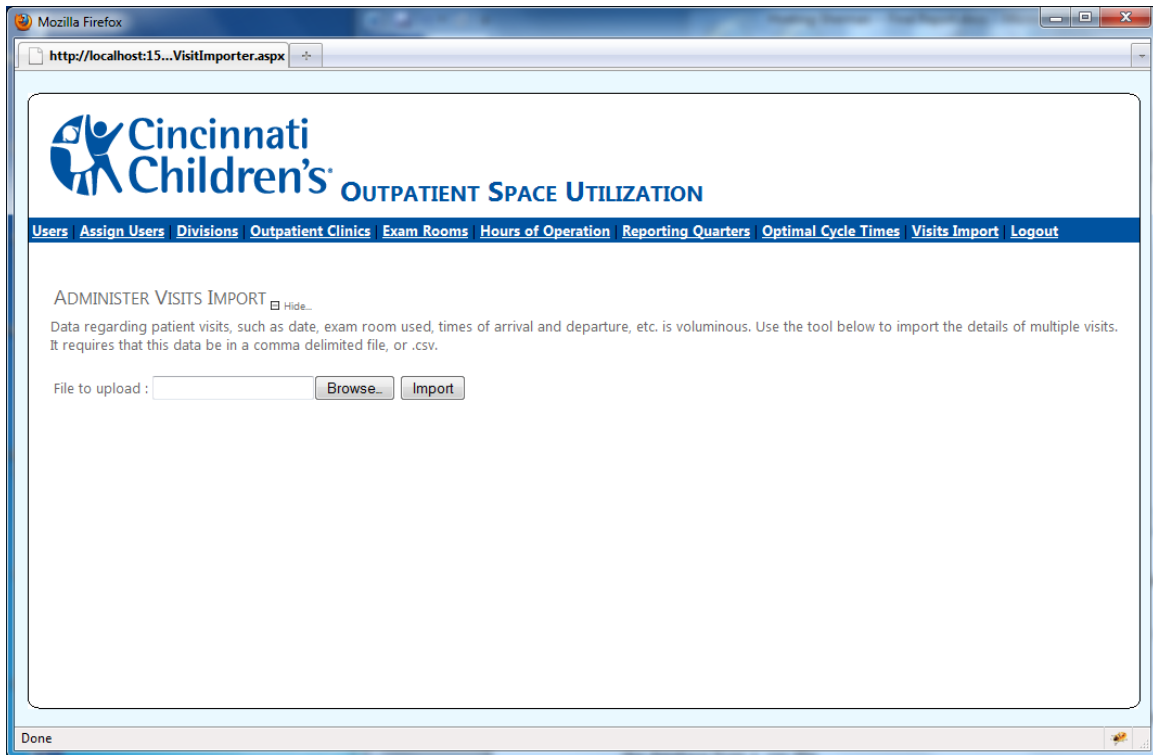


Figure 40. Importing patient visit data

As shown in Figure 40, the SA can browse for a .csv file and click the *Import* button to pull in multiple records of patient visits. Figure 41 is a partial image of such as file.

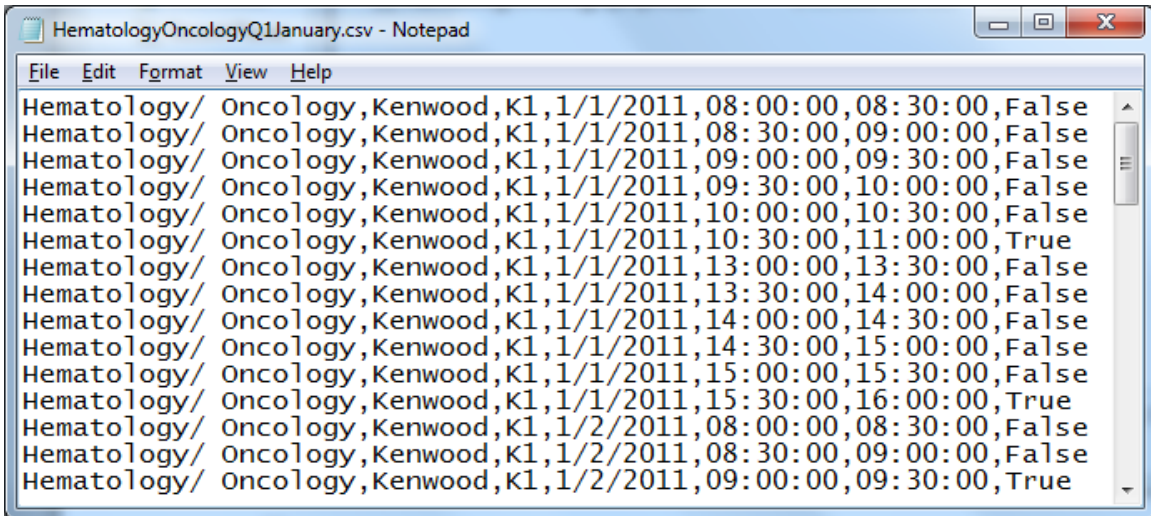


Figure 41. Bulk visit data

After importing these records, the application gives the SA feedback as to how many records were successfully imported, how many were defective and ignored, and if any were duplicates. See Figure 42.

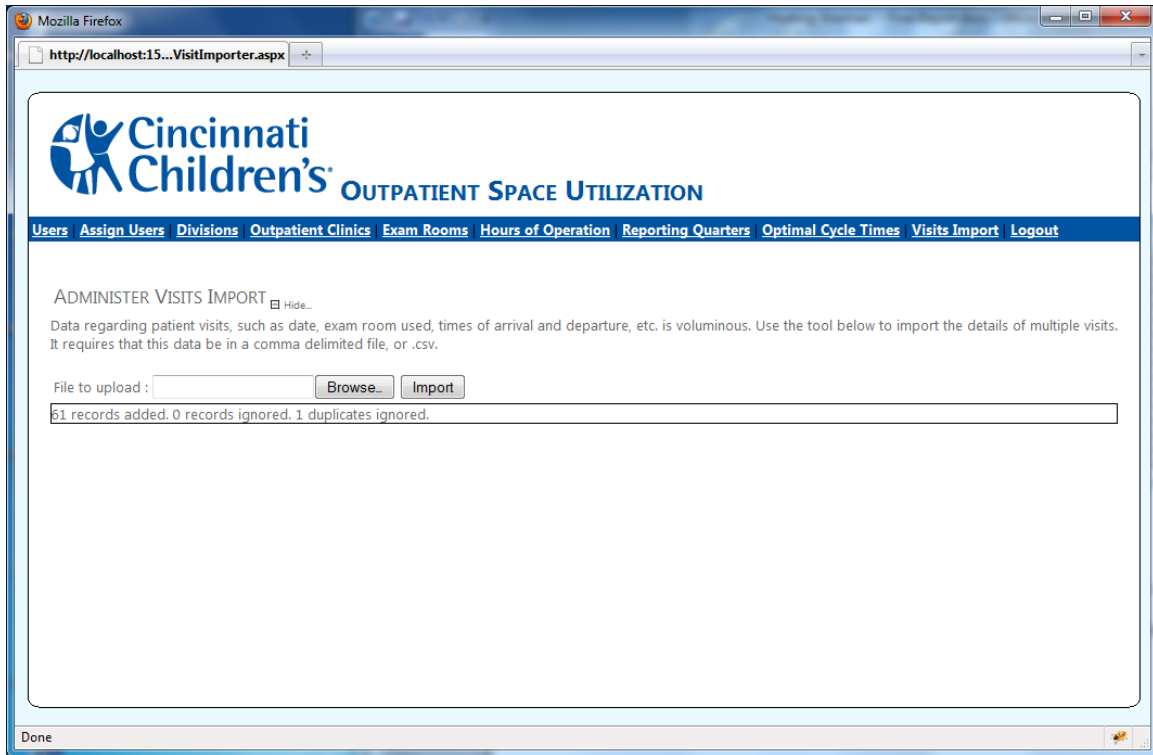


Figure 42. Feedback display after importing January's records

To complete the scenario with the Director of Hematology, we will log out and log back in as that newly created user. Upon logging in and running a report, the utilization for the Division of Hematology/ Oncology and the Kenwood Clinic is displayed, aggregated by the day of the week. See Figure 43.

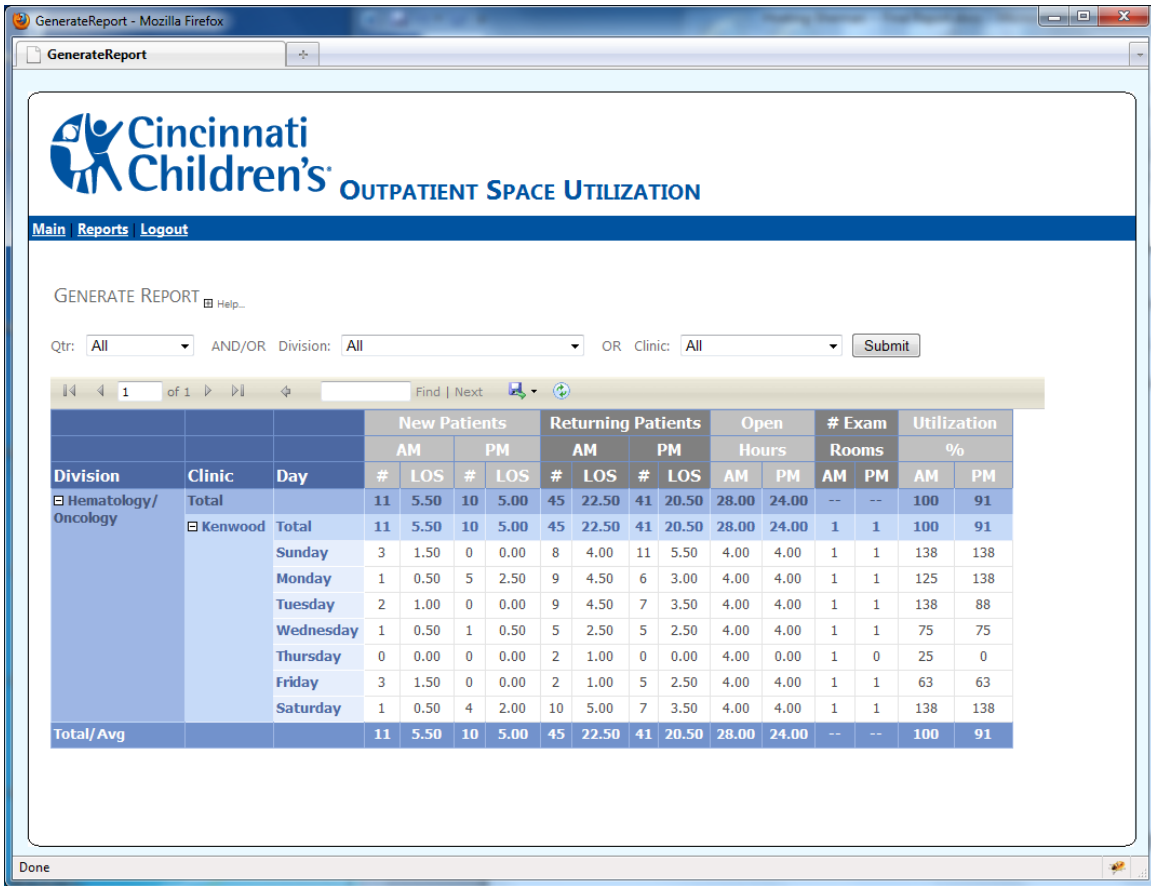


Figure 43. Report for the Director of Hematology

Now let us take a look at the rest of the System Administrator's tools. The *Outpatient Clinics* page allows the SA to add and edit data for clinic locations, similar to the method illustrated earlier for users. The search feature is also similar. See Figure 44.

Cincinnati Children's OUTPATIENT SPACE UTILIZATION

Users Assign Users Divisions Outpatient Clinics Exam Rooms Hours of Operation Reporting Quarters Optimal Cycle Times Visits Import Logout

ADMINISTER OUTPATIENT CLINICS Help...

Search: Name Search Add

Name	Street	Unit	City	State	Zip	Cycle Time	Edit
Harrison	10450 New Haven Road		Cincinnati	OH	45030	0.5 Hours	Edit
Anderson	7495 State Road	Suite 355	Cincinnati	OH	45255	0.5 Hours	Edit
Drake	151 West Galbraith Road		Cincinnati	OH	45216	0.5 Hours	Edit
Eastgate	796 Cincinnati-Batavia Pike		Cincinnati	OH	45245	0.5 Hours	Edit
Fairfield	3050 Mack Road		Fairfield	OH	45014	0.5 Hours	Edit
Kenwood	7714 Montgomery Road	Suite A	Cincinnati	OH	45236	0.5 Hours	Edit
Liberty Campus	7777 Yankee Road		Liberty Township	OH	45044	0.5 Hours	Edit
Mason Campus	9560 Children's Drive		Mason	OH	45040	0.5 Hours	Edit
Northern Kentucky	2765 Chapel Place		Crestview Hills	KY	41017	0.5 Hours	Edit
Oak Campus	2800 Winslow Avenue	Third Floor	Cincinnati	OH	45206	0.5 Hours	Edit
Main Campus	3333 Burnet Avenue		Cincinnati	OH	45229	0.5 Hours	Edit
Hopple Street Center	2750 Beekman Street		Cincinnati	OH	45225	0.5 Hours	Edit
Batesville	508 South Mulberry Street		Batesville	IN	47006	0.5 Hours	Edit
College Hill Campus	5642 Hamilton Avenue		Cincinnati	OH	45224	0.5 Hours	Edit

Figure 44. Page for maintaining clinic information

Maintenance of exam room data is performed on the *Exam Rooms* page. Cycle time here refers to the target length of stay for a clinic. Different clinics may strive to achieve different cycle times to meet their efficiency goals.

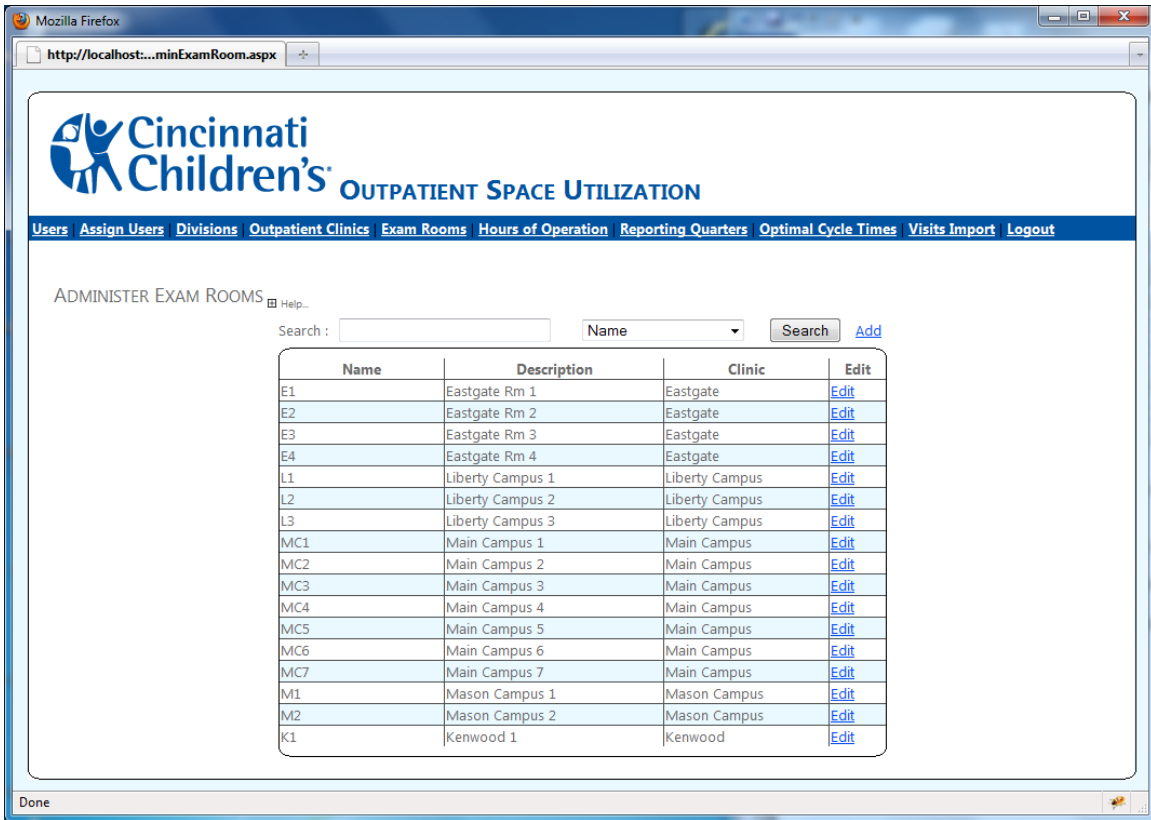


Figure 45. Page for maintaining exam room information

Each exam room that has been added to the database through the application is assigned *Hours of Operation*. This page shows the morning and afternoon open and close times. See Figure 46.

ADMINISTER HOURS OF OPERATION [Help...](#)

Search Exam Room Name:

Exam Room Name	AM Open Time	AM Close Time	PM Open Time	PM Close Time	AM Open Hours	PM Open Hours	
E1	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
E2	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
E3	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
E4	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
L1	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
L2	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
L3	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
MC1	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
MC2	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
MC3	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
MC4	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
MC5	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
MC6	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
MC7	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
M1	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
M2	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit
K1	8:00 AM	12:00 PM	1:00 PM	5:00 PM	4.000	4.000	Edit

Figure 46. Page for maintaining hours of operation information

Reports are generated for quarterly data. The *Reporting Quarters* page is used to change the dates for reporting quarters.

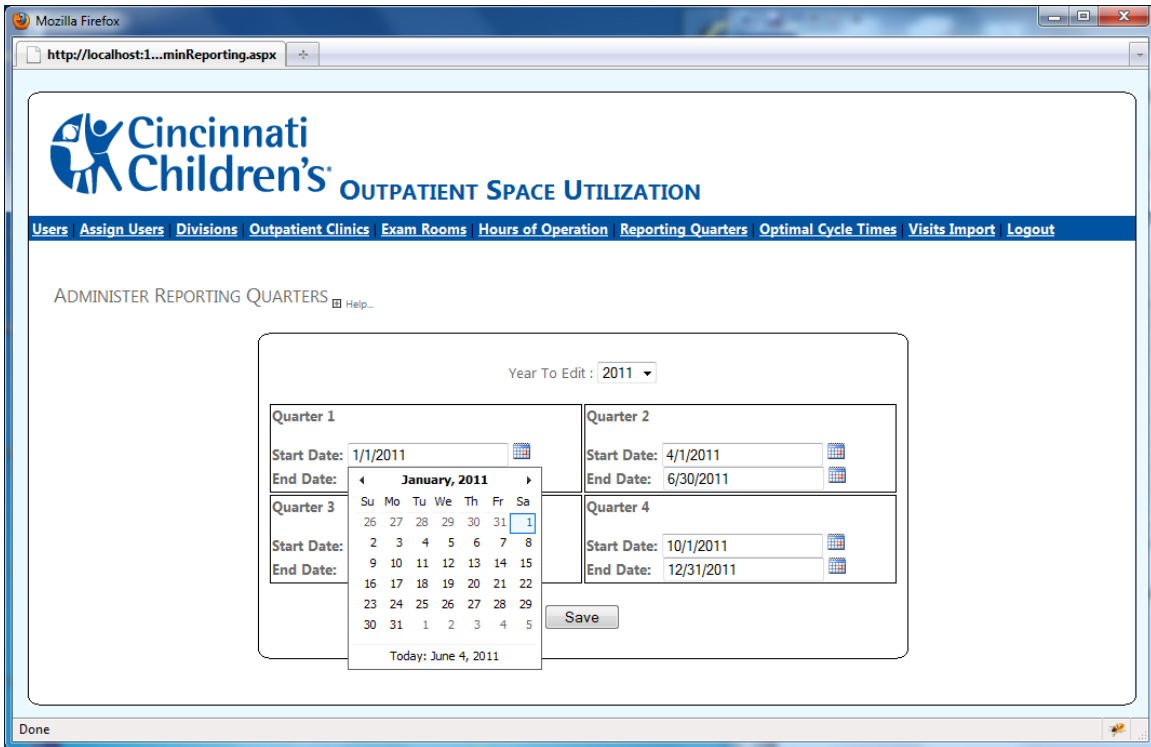


Figure 47. Page for maintaining reporting quarter information

Finally, the *Optimal Cycle Times* page allows the SA to add and edit target cycle times. If a time is entered here, it will be available to assign to a clinic when adding or editing on that page respectively. See Figure 48.

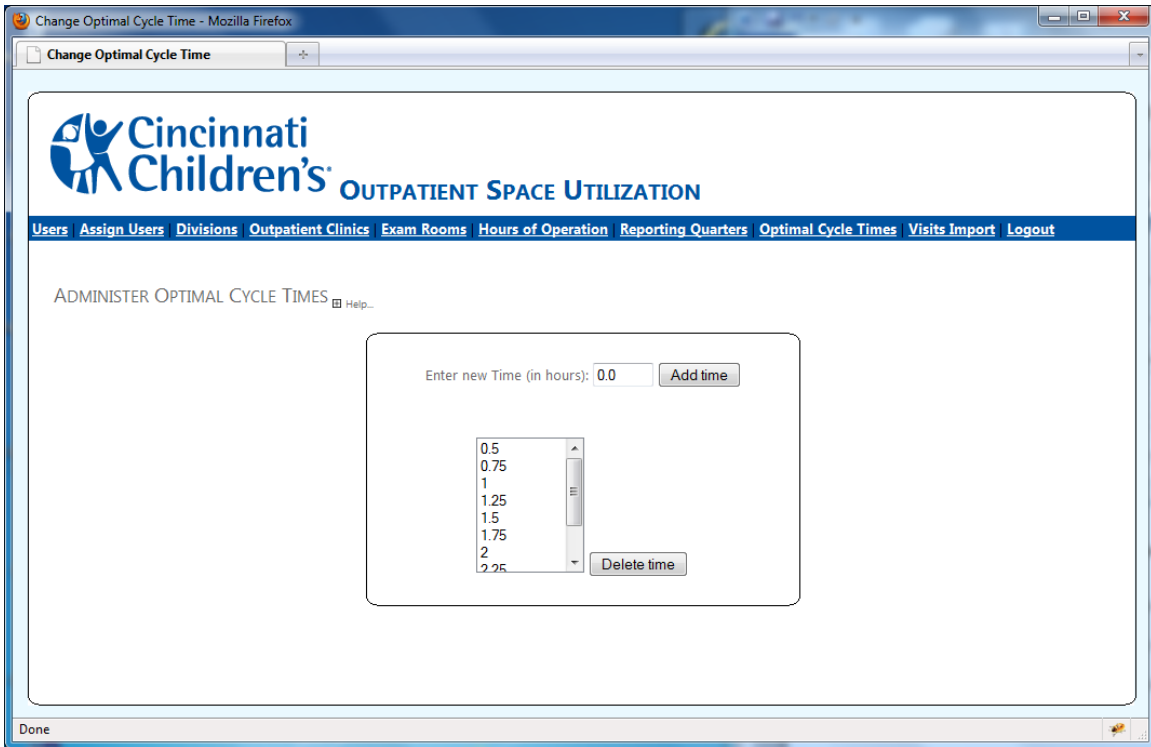


Figure 48. List of possible target cycle times for clinics

As shown below in Figures 49 and 50, the input data on this page is validated. Figure 49 shows the result of trying to add a time outside of the allowable range. Figure 50 shows the result of trying to add nothing or other non-numeric characters.

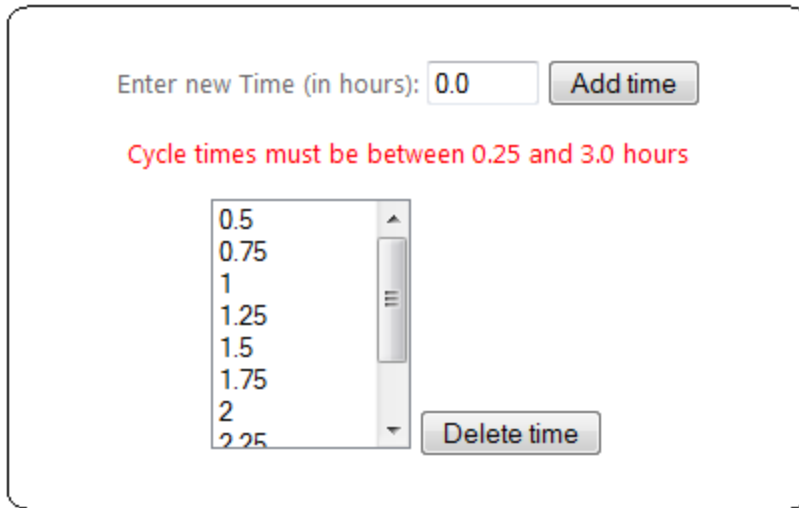


Figure 49. Value validation

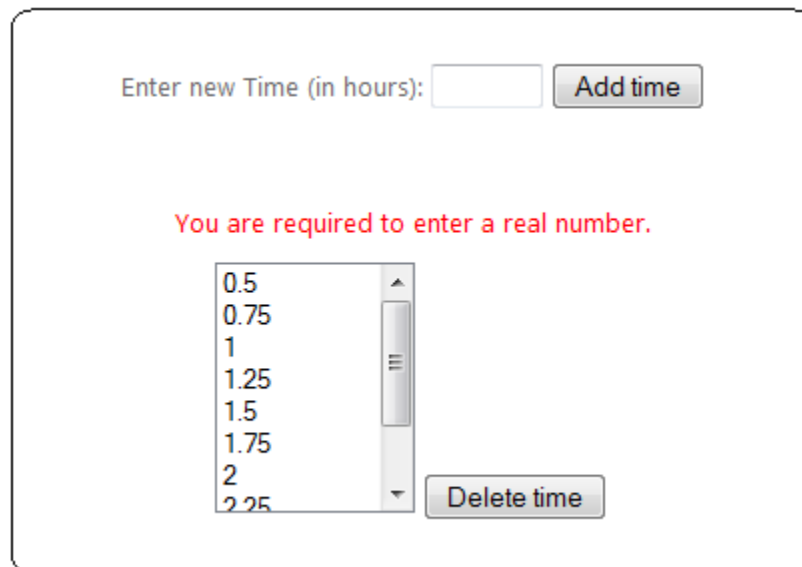


Figure 50. Non--numeric character validation

6. Testing

Testing of the database was done independently through SQL Server Management Studio (SSMS). Queries were run against the tables each time a change was made to the database. Create, read, update and delete (or CRUD) statements were run in SSMS to isolate any influences the application logic might have on the result sets. This is also the case for cascading updates and deletes that have an effect on related tables.

User testing was performed on the application to solicit critical feedback for improvement. Five users performed tasks that simulate common usage in a production environment. The tasks covered the critical functionality and addressed the intent of our objectives for the application.

The most common theme from user testing feedback was that we needed to offer more feedback to the user when the system is processing. On a number of occasions errors appeared as a result of the user clicking multiple times on controls while the system was still processing the original request. Users were unaware that the system was working and therefore continued to click and select various options, causing the errors. Other feedback suggested we grey out controls while the application is processing to prevent these scenarios from happening.

Our contacts at CCHMC were also able to view the application and their feedback was positive. Because we were unable to have actual hospital staff (Business Directors) use the application, our user testing was performed by fellow students. Complete testing results are contained in Appendix A.

7. Conclusion and Recommendations

A Cincinnati Enquirer article printed on Nov. 29th 2010 sums up the problem area of our project quite well. CCHMC CFO, Scott Hamlin, states “Our goal is that nobody waits more than 10 days for an appointment” (14). This enhanced delivery of care will be accomplished through productivity instead of new construction. “The hospital’s top priorities include cutting \$50 million in non-salary costs during the next five years, *boosting the utilization of its existing buildings by 20 percent* and reducing its per-patient cost by 5 percent” (14).

In order to achieve these goals, CCHMC requires solutions that help them understand space utilization factors. Our project is one of those solutions. It focuses on operations for outpatient services.

Our application solution measures current outpatient exam room space utilization. The basis of our project is storing, analyzing and presenting outpatient data. Being able to simulate the number of exam rooms and usage demand, Business Directors aim to optimize their use of space.

Given CCHMC’s goal of achieving optimal utilization of fixed resources, our solution, by making data available that is was unavailable, enables the hospital to maximize care while driving out unnecessary time and cost associated with patient flow through outpatient exam rooms.

Our recommendation, based largely off of the user testing feedback, includes focusing more time on user response. If the project was recreated, we suggest approaching it in more of an iterative way. By having users test each iteration of our application we would have caught more feedback up front in the design process.

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Appendix A: User Testing Results

User Testing Scenarios:

CHRISTIAN BROWN

1) Login as an Admin, and create a new user account for the Director of Hematology.

Steps/Information:

- Login credentials for Admin are username="Administrator", password="password".
- Create new user and give that user a username of "DirectorOfHematology".
- The role assigned to the new user should be "User" NOT "Admin".
- Put in your name where names are required, and input the password "password".

COMMENTS: Like the Note after logging in as admin- Good Feedback

Slight confusion between where to create users, but once I found it, very easy. Maybe a hover over each menu item.

2) Assign privileges, Divisions, and Clinics. Also, import health records.

Steps/Information:

- Assign the "Hematology/ Oncology" Division to the newly created user. Went to Edit User instead of Assign user
- Check to make sure the "Hematology/ Oncology" Division operates out of the Kenwood Clinic. If not, assign the Kenwood Clinic to that Division.
- Import health records from the two files "HematologyOncologyQ1January.csv" and "HematologyOncologyQ2April.csv". Location of files will be given.
- Log out of the "Administrator" account.

COMMENTS:

Getting hung up on local host first time it's pressed. During the wait to import, maybe a spiny circle or something to show that it is working. Nice feedback on the upload. Logged out during second import. ~~Didn't~~ took a long time after re-login.

3) Login as the newly created Director of Hematology, and view utilization.

Steps/Information:

- View drilldown and change some parameters by clicking the "?" at the end of a row.
- View a report of the data with various options.
- Export a report to .pdf format.
- Log out of the "DirectorOfHematology" account.

COMMENTS:

- Inputted password incorrectly - did not login - worked after proper credentials
- Stack Trace error when opening Hematology/Oncology drill down
- Encountered Fatal errors when viewing utilization - Had to restart app

4) Login as a different Director at the hospital and view utilization.

Steps/Information:

- Login with credentials of username="SpecialDirector", password="password"
- View the utilization of the Divisions and Clinics assigned to this user.
- Pay special attention to the values.
- Log out of the "SpecialDirector" account.

COMMENTS:

5) Log back in as the Administrator, make changes, and view resulting utilization.

Steps/Information:

- Login as the Admin with the credentials above.
- Change the date period of Quarter 1 of 2011. Make the start date Feb. 1st.
- Press save and log out of the Admin account.
- Log back in as "SpecialDirector".
- View utilization after the change, and then log out.

COMMENTS:

Fairly intuitive app

Had some errors because I interrupted the process, without realizing. When I wait until it loads, it's fine.

- Grey out the button until Fully loaded

App has real possibilities - Hope it continues to develop.

User Testing Scenarios:

Moher Sadr

1) Login as an Admin, and create a new user account for the Director of Hematology.

Steps/Information:

- Login credentials for Admin are username="Administrator", password="password".
- Create new user and give that user a username of "DirectorOfHematology".
- The role assigned to the new user should be "User" NOT "Admin".
- Put in your name where names are required, and input the password "password".

COMMENTS:

~~It is no~~ when I entered my username had probs creating user

2) Assign privileges, Divisions, and Clinics. Also, import health records.

Steps/Information:

- Assign the "Hematology/ Oncology" Division to the newly created user.
- Check to make sure the "Hematology/ Oncology" Division operates out of the Kenwood Clinic. If not, assign the Kenwood Clinic to that Division.
- Import health records from the two files "HematologyOncologyQ1January.csv" and "HematologyOncologyQ2April.csv". Location of files will be given.
- Log out of the "Administrator" account.

COMMENTS:

I was not sure where to go, I was confused abt importing records, when imp. data I got error

3) Login as the newly created Director of Hematology, and view utilization.

Steps/Information:

- View drilldown and change some parameters by clicking the "?" at the end of a row.
- View a report of the data with various options.
- Export a report to .pdf format. - not sure how to do that
- Log out of the "DirectorOfHematology" account.

COMMENTS:

4) Login as a different Director at the hospital and view utilization.

Steps/Information:

- Login with credentials of username="SpecialDirector", password="password"
- View the utilization of the Divisions and Clinics assigned to this user.
- Pay special attention to the values. most are zero
- Log out of the "SpecialDirector" account.

COMMENTS:

5) Log back in as the Administrator, make changes, and view resulting utilization.

Steps/Information:

- Login as the Admin with the credentials above.
- Change the date period of Quarter 1 of 2011. Make the start date Feb. 1st.
- Press save and log out of the Admin account.
- Log back in as "SpecialDirector".
- View utilization after the change, and then log out.

COMMENTS:

was able to view a percentage

1) Login as an Admin, and create a new user account for the Director of Hematology.**Steps/Information:**

- Login credentials for Admin are username="Administrator", password="password".
- Create new user and give that user a username of "DirectorOfHematology".
- The role assigned to the new user should be "User" NOT "Admin".
- Put in your name where names are required, and input the password "password".

COMMENTS:

Clicked insert to add the User and it didn't update right away but still worked.

2) Assign privileges, Divisions, and Clinics. Also, import health records.**Steps/Information:**

- Assign the "Hematology/ Oncology" Division to the newly created user.
- Check to make sure the "Hematology/ Oncology" Division operates out of the Kenwood Clinic. If not, assign the Kenwood Clinic to that Division.
- Import health records from the two files "HematologyOncologyQ1January.csv" and "HematologyOncologyQ2April.csv". Location of files will be given.
- Log out of the "Administrator" account.

COMMENTS:

Checked edit user to add divisions/by default help should be confusing on adding "Hematology/oncology" out but can be collapsible
 - need something saying it updated successfully. Hung up on imports.

3) Login as the newly created Director of Hematology, and view utilization.**Steps/Information:**

- View drilldown and change some parameters by clicking the "?" at the end of a row.
- View a report of the data with various options.
- Export a report to .pdf format.
- Log out of the "DirectorOfHematology" account.

COMMENTS:

Stuck trace error trying to view the drilldown

4) Login as a different Director at the hospital and view utilization.**Steps/Information:**

- Login with credentials of username="SpecialDirector", password="password"
- View the utilization of the Divisions and Clinics assigned to this user.
- Pay special attention to the values.
- Log out of the "SpecialDirector" account.

COMMENTS:**5) Log back in as the Administrator, make changes, and view resulting utilization.****Steps/Information:**

- Login as the Admin with the credentials above.
- Change the date period of Quarter 1 of 2011. Make the start date Feb. 1st.
- Press save and log out of the Admin account.
- Log back in as "SpecialDirector".
- View utilization after the change, and then log out.

COMMENTS:

Pages need to fully load before being able to navigate or you get an error that breaks the page.

User Testing Scenarios:

Raechel Moermond

1) Login as an Admin, and create a new user account for the Director of Hematology.

Steps/Information:

- Login credentials for Admin are username="Administrator", password="password".
- Create new user and give that user a username of "DirectorOfHematology".
- The role assigned to the new user should be "User" NOT "Admin".
- Put in your name where names are required, and input the password "password".

COMMENTS:

I took a guess on whether I should go to users or assign users.
The link to add users should be bigger - more obvious.

2) Assign privileges, Divisions, and Clinics. Also, import health records.

Steps/Information:

- Assign the "Hematology/ Oncology" Division to the newly created user. - Assign users
- Check to make sure the "Hematology/ Oncology" Division operates out of the Kenwood Clinic. If not, assign the Kenwood Clinic to that Division. - Divisions
- Import health records from the two files "HematologyOncologyQ1January.csv" and "HematologyOncologyQ2April.csv". Location of files will be given.
- Log out of the "Administrator" account.

COMMENTS:

visits import is not a good menu option. it should be exactly what the user is doing - import records.

3) Login as the newly created Director of Hematology, and view utilization.

Steps/Information:

- View drilldown and change some parameters by clicking the "?" at the end of a row.
- View a report of the data with various options.
- Export a report to .pdf format. - Didn't complete - page kept breaking
- Log out of the "DirectorOfHematology" account.

COMMENTS:

Drilldown does not work - cannot expand Kenwood - slow
load so clicked a second time - all kinds of error messages
its so slow that 90%+ users will click a second time especially
since there is no indication that it is working
Drill down would not work for Q1 at all - selecting
quarter changes months
user select months
column labels
mean nothing to
me - number of
exam rooms,
% used

4) Login as a different Director at the hospital and view utilization.

Steps/Information:

- Login with credentials of username="SpecialDirector", password="password"
- View the utilization of the Divisions and Clinics assigned to this user.
- Pay special attention to the values.
- Log out of the "SpecialDirector" account.

COMMENTS:

Switched to Q1 - error message - "there is already an open data reader associated with this command which must be closed first" - Changing months results in more errors
If the quarter hasn't happened it shouldn't be an option on reporting - freeze top rows of report so column headers exist as you scroll

5) Log back in as the Administrator, make changes, and view resulting utilization.

Steps/Information:

- Login as the Admin with the credentials above.
- Change the date period of Quarter 1 of 2011. Make the start date Feb. 1st.
- Press save and log out of the Admin account.
- Log back in as "SpecialDirector".
- View utilization after the change, and then log out.

COMMENTS:

No data for starting in February - there should be some kind of message that says there is no data to display

10/15/13

User Testing Scenarios:

1) Login as an Admin, and create a new user account for the Director of Hematology.

Steps/Information:

- Login credentials for Admin are username="Administrator", password="password".
- Create new user and give that user a username of "DirectorOfHematology".
- The role assigned to the new user should be "User" NOT "Admin".
- Put in your name where names are required, and input the password "password".

COMMENTS:

- Ran into a Server error upon login
- "Privlidges" should be "privileges"

2) Assign privileges, Divisions, and Clinics. Also, import health records.

Steps/Information:

- Assign the "Hematology/ Oncology" Division to the newly created user.
- Check to make sure the "Hematology/ Oncology" Division operates out of the Kenwood Clinic. If not, assign the Kenwood Clinic to that Division.
- Import health records from the two files "HematologyOncologyQ1January.csv" and "HematologyOncologyQ2April.csv". Location of files will be given.
- Log out of the "Administrator" account.

COMMENTS:

- Wasn't sure how to check where Hematology/Oncology operates
- "working" dialog would be nice for import
- "duplicates" should be "duplicatess"
- prompted to login after second import...?

3) Login as the newly created Director of Hematology, and view utilization.

Steps/Information:

- View drilldown and change some parameters by clicking the "?" at the end of a row.
- View a report of the data with various options.
- Export a report to .pdf format.
- Log out of the "DirectorOfHematology" account.

COMMENTS:

- Cannot double click
- maybe highlight changes? Didn't know it had changed
- Report Generator is cool!

4) Login as a different Director at the hospital and view utilization.

Steps/Information:

- Login with credentials of username="SpecialDirector", password="password"
- View the utilization of the Divisions and Clinics assigned to this user.
- Pay special attention to the values.
- Log out of the "SpecialDirector" account.

COMMENTS:

- Maybe tell user to wait until fully loaded

5) Log back in as the Administrator, make changes, and view resulting utilization.

Steps/Information:

- Login as the Admin with the credentials above.
- Change the date period of Quarter 1 of 2011. Make the start date Feb. 1st.
- Press save and log out of the Admin account.
- Log back in as "SpecialDirector".
- View utilization after the change, and then log out.

COMMENTS:

- Unsure of how to change things